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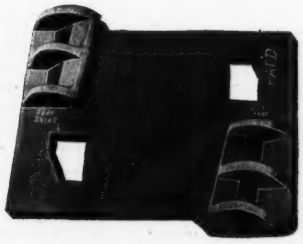
New Series, Vol. IX
Old Series, Vol. XXVIII | *Chicago* | SEPTEMBER, 1913 | *New York* | No. 9



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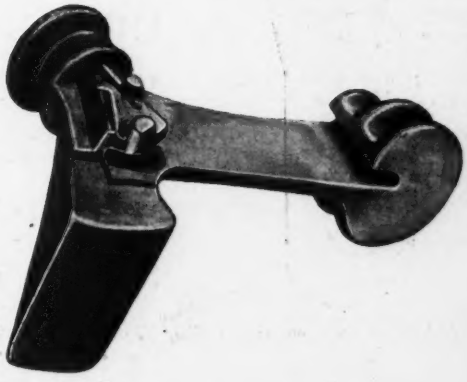

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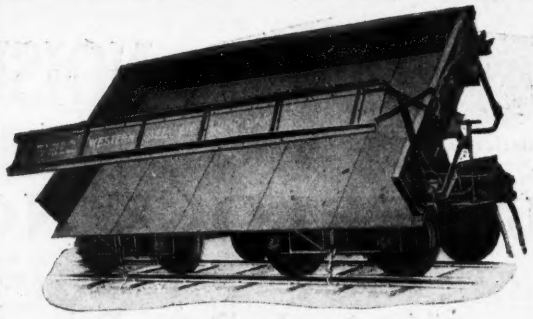

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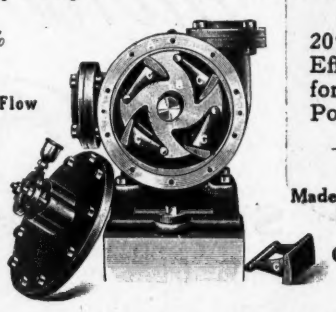

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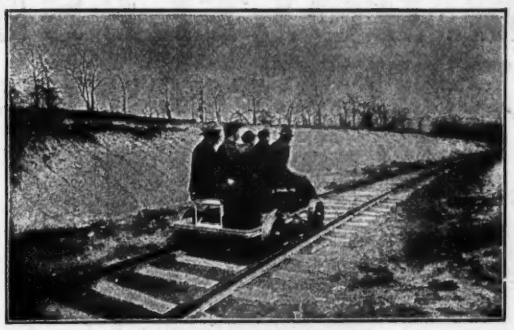

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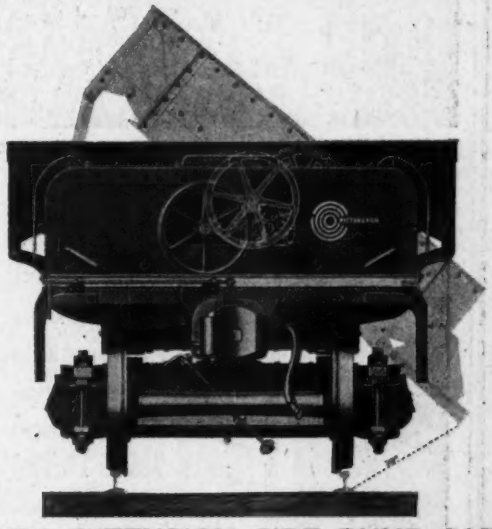

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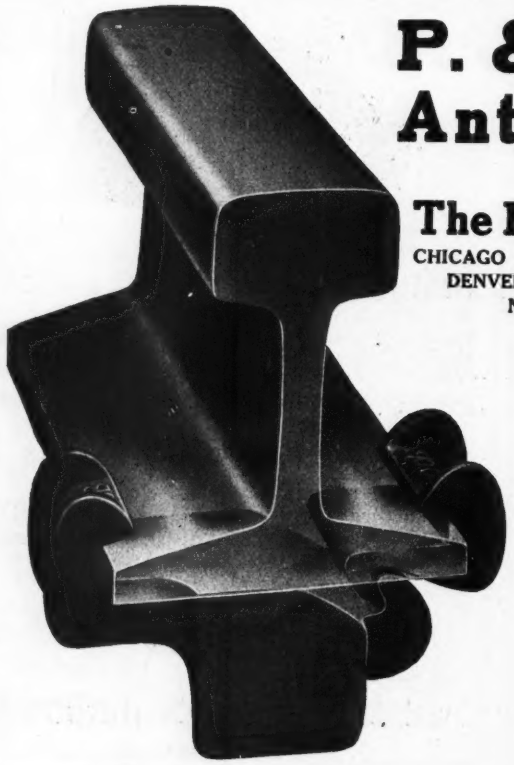

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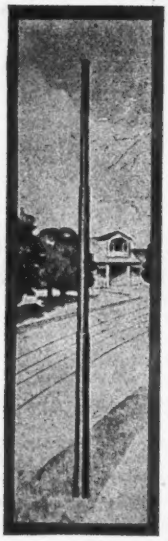

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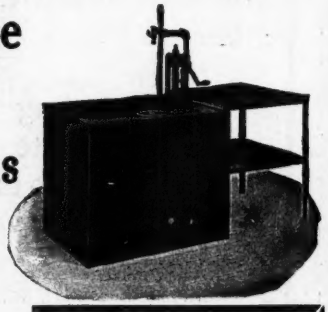

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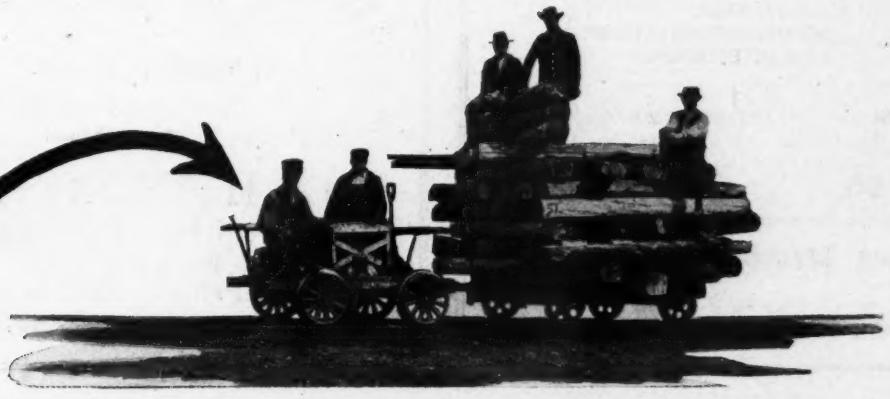

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I have handled 10 and 12 men on my car with tools to work with, and made 30 miles per hour. I hauled a push car behind the motor car with 28 persons on the two cars and made 7 miles in 25 minutes.

I now have an extra gang. I pull a push car behind and carry 38 men on the cars, and it's a little up grade. Enclosed find photograph of myself and section gang that was taken in May."—J. W. Hardin, Foreman, C., M. & St. P. Ry., Powersville, Mo.

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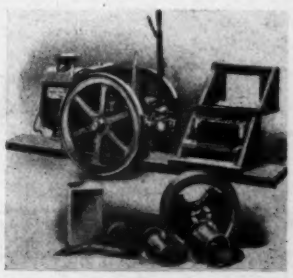
Costs less than you think—easy payments.



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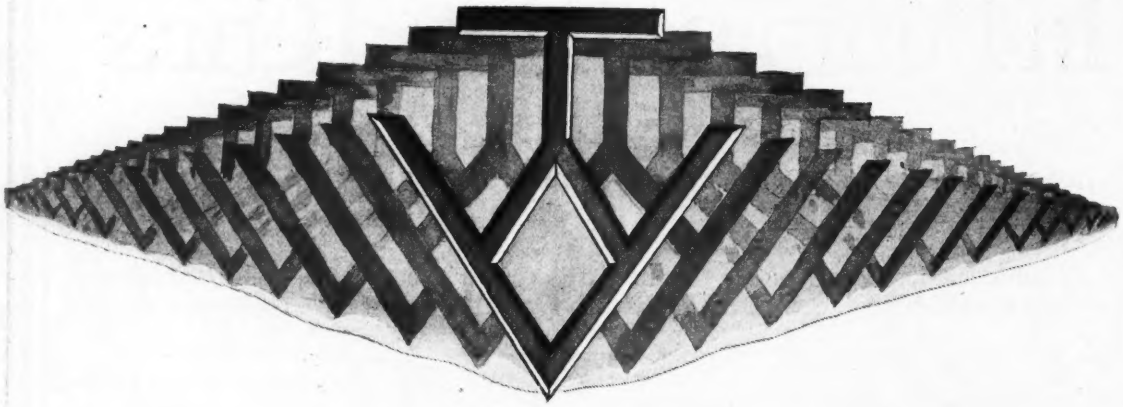

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BRIDGES--BUILDINGS--CONTRACTING--SIGNALING--TRACK

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DALTON RISLEY, Western Manager

Contributing Editors: A. M. WOLF, C. E. (Concrete); J. G. VAN ZANDT, C. E. (Economics); B. W. MEISEL (Signaling)

Office of Publication: Manhattan Building, Chicago
Telephone, Harrison 4948

Eastern Office: 50 Church Street, New York
Telephone, Courtlandt 5765

Central Office: House Bldg., Pittsburgh

Address all Editorial and Business Communications to the Company at Chicago

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This Publication has the largest paid circulation of any railway journal in the Maintenance of Way field.

Entered as Second-Class matter April 13, 1905, at the Post Office at Chicago, Illinois, Under the Act of Congress of March 3, 1879.

New Series Vol. 9
Old Series, Vol. 23

Chicago, September, 1913 No. 9

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Reducing Hand Labor.

THE ADOPTION of use of a concrete distributing tower, mounted on a flat car, the installation of which is mentioned on another page of this issue, illustrates the present increasing tendency to cut down hand labor. On some jobs, and in certain seasons, it is no more a question of whether or no the substitution of power will bring a financial saving, although the latter is usually the case. Rather, the question is, shall the work be vigorously pushed by the use of power equipment, or shall it lag along depending on the half hearted efforts of disinterested or occasionally openly defiant laborers?

A machine, properly constructed, is dependable. Its capacity can, in general, be figured out to a nicety. And furthermore, necessary light repairs can be made after working hours; in fact, with high grade equipment, a machine can almost be depended on for every working day in the year.

Compare this dependability, this almost exact knowledge of capacity and results to be attained, to the widely varying results obtained from two different gangs of laborers, with the widely varying results obtained from the same gang in different periods, and with the unreliability or the uncertainty occasioned by frequent lay offs, men quitting, or whole gangs quitting.

It is possible in a great many cases that when overhead expenses for the year are charged up against equipment that is idle a considerable portion of the time, little saving or cheapening of that particular phaze of the work is noticeable. But the increased speed or dependability results in more efficient organization and planning of the rest of the work, thus cheapening it as a whole in no inconsiderable degree.

There are places, of course, where the use of power equipment is of very special advantage—for instance, in excavating wet material. Even disregarding the natural reluctance and dissatisfaction of laborers excavating in muddy soil, such work is very expensive, due to the inability of the laborer to obtain a solid footing, and to unload his shovel with any degree of speed or efficiency.

The use of power equipment in maintenance, and more especially in construction, is on the increase, and rightly so. The result of this policy, under efficient management is lower ultimate cost, freeing the construction officials from much of the detail and giving them more time for planning and devising better methods.

Purchasing Track Tools

IN PRIVATE LIFE no man would think of letting another pick out and purchase the things on which his health and comfort depend. Of course, such procedure would be satisfactory if all men were the same size, and needed the same kinds of goods, but such a hypothesis is ridiculous. In other words, if the conditions were the same for every man, then anyone would be justified in making all his purchases by proxy.

If you will grant, then, that it is impractical and impolitic to allow another to purchase all your personal necessities, is is not just as foolish to allow the purchase of railway supplies and tools on such a basis?

Men in charge of purchasing usually become astute bargainers; in other words, they become adept at obtaining supplies at the lowest prices the salesman can concede. But this faculty,

however acutely developed, has nothing in common with the actual necessities of the men who use such tools and materials. And for this reason no purchasing official should have the right to change the manufacturer's name on a specification unless tests made by the department using same have proven other brands equal or superior. The buyer should endeavor to drive the best bargain on those materials which will best fit the condition.

No track man or engineer should ever fail to describe the kinds and makes of materials and tools for which he makes requisition. For he is the only man who knows absolutely the conditions which are to be met.

We all know that conditions are different for every section of the country. Costs for maintaining a railway in flat country cannot be equitably compared to the cost in a hilly country, with sharp curves and heavy grades. The same is true of construction and operation, and tools and equipment suitable for one location may be extremely inefficient for another location.

Who thinks of using an ordinary track shovel for sewer digging? No one but a railway official. In one instance, a half dozen spades, even though they were of poor quality, materially increased the amount of work of a gang excavating for retaining walls. And this is no exception to the rule; thousands of dollars can be saved by judicious selection of tools. Shovels for devil-may-care extra gangs unloading gravel and sand, should not be of high quality. They will be lost before being worn out; 56 were buried in one bunch in the sand on Chicago track elevation work, and were accidently discovered later in digging a manhole. Hundreds of others were buried and not found. But section gangs are usually careful of tools and should be furnished those of high quality.

If we would not allow others to pick out and make our personal purchases, why should we allow others to make purchases of tools or equipment on which we are building our personal reputation and advancement? Any man, no matter how low his position, should be allowed to at least make suggestions as to tools and makes of tools to be used, provided he displays intelligence, and a real interest in the matter.

Operation of Motor Cars

WITHIN a few weeks a serious accident occurred which involved the indiscriminate use of a motor section car. A signal supervisor operating a light gasoline inspection car collided with a power section car loaded with ball players, in a tunnel. It appears that the signal supervisor had made the attempt to block himself through the tunnel by telephoning to the farther end, but that the watchman was off duty, the day being Sunday. He took a chance and met the section car proceding in the opposite direction, the man in charge of the latter vehicle having taken no precautions whatever. Train service on the division in question was practically suspended over Sunday and it is probable that both cars were operating with safety, so far as the possibility of meeting trains was concerned.

This accident introduces a new problem for the operating officers to solve, with the assistance, it is hoped, of all who are interested in the small motor car. When power inspection cars were limited to the use of one or two men on a division, there was little danger of their interference with one another, but their adaptability and availability in increasing the efficiency of all men or gangs whose duties call for more or less transportation through their districts to and from their work, has increased the number of power cars in use surprisingly. A condition, which will be accentuated by more accidents, has arisen and must be carefully considered. Rigid rules for the operation of all classes of power inspection and section cars must be formulated and enforced. The more carefully these cars are operated the better served are the interests of those who are developing them. It does not seem practical to attempt the operation of these cars by train order, and they cannot, of course, be allowed to operate automatic signals. A kind of station block system is the simplest solution and seems to be the only solution.

THE ARMY OF GOD-KNOWS-WHERE.

By Alfred Damon Runyon.

Dedicated to our Civil Engineers.

No bands are playing gaily when they're going into action,
No crowds are cheering madly at their deeds of derring-do;
They are owing small allegiance to any flag or faction—
Their colors on the sky-line and their war cry, "Put it through."

Ahead of bath and Bible and, of late, repeating rifle,
The flags can only follow to the starting of their trail;
They heard the leagues behind them, every mile the merest trifle;
They mark the paths of safety for the slower sail and rail.

Their standards kiss the breezes from the Arctic's cooling ices
To where the South Pole's poking out its new-discovered head;
You can see their chains a-snaking through the lands of rum and spices—
And east and west you'll always find their unrepining dead.

No time for love and laughter, with their rods upon their shoulders.
No time to think with vain regret of home or passing friends.
They are slipping down the chasms, charging up the mighty boulders,
The compass stops from overwork, the pathway never ends.

They slit the gullet of the earth; disgorge its hoarded riches
(But life's too short for them to stop and snatch a rightful share);
They've a looking on the Congo putting in some water ditches;
A dating to take tea with death; they make it by a hair.

You will find their pickets watching in the unexpected places;
You will hear them talking freely of The-Things-That-Can't Be-Done;
Oh, the Faith they speak so strongly and Hope that's in their faces—
It lights the gloom of What's-the-Use as brightly as the sun.

No bands are playing gaily and no crowds are madly cheering;
No telegraph behind them tells their deeds of derring-do,
But forward goes the legion, never doubting, never fearing—
Their colors on the sky-line and their war cry, "Put it through."—*Indian and Eastern Engineer.*

SIGNAL MEETINGS AT KARPEN BUILDING.

The meeting rooms in connection with the Railway Supply Exhibit, Karpen Building, Chicago, were used for meetings of Committee 5 of the RAILWAY SIGNAL ASSOCIATION, August 8, and also Committee 6, August 9.

The WESTERN SIGNAL ENGINEERS will meet in these rooms September 10. This meeting was formerly called for July 10, but it was postponed.

Design of Retaining Walls*

By A. W. Hoffmann.

In addition to the types of walls discussed before, a good many special types are to be found in cases where the local conditions cannot be satisfied by ordinary methods. Track elevation and depression sometimes offer difficult and intricate problems, the solution of which can only be found by careful study of all conditions which might affect the design of the wall under consideration. Frequently the footings of the retaining walls must be kept entirely inside the property lines without encroaching on the street, and in all cases footings must be kept off the adjoining property. If the railroad's right of way is narrow, and a number of tracks is to be accommodated, then it will be necessary to design retaining walls without a projecting toe. Figs. 64 and 65 show two entirely different solutions of this problem. We are indebted to the Engineering News, 1911 and 1912, for these examples. Fig. 64 shows a retaining wall on the Chicago, Milwaukee & St. Paul Railway Company's right of way in Elgin, Ill. For a description of this wall and a comparison with other types the reader is referred to Mr. J. H. Prior's article in the Engineering News of April 20, 1911.

Fig. 65 is a cross section through a retaining wall on the Chicago & North-Western Terminal Line in Chicago, which is

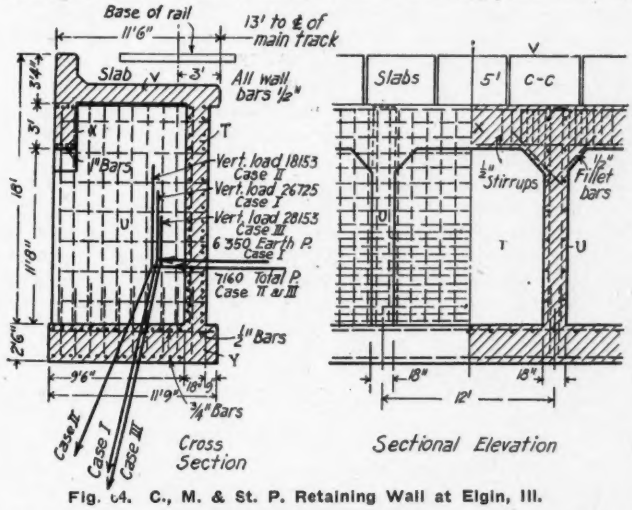


Fig. 64. C., M. & St. P. Retaining Wall at Elgin, Ill.

described in the Engineering News of Feb. 15, 1912. This wall is another highly interesting example of what can be done if the toe of the wall must not project beyond the face of the wall.

Figs. 66 to 72 show various sections through a 66-foot railroad right of way, which is to accommodate three, four and five tracks on an elevated and on a depressed grade. Careful estimates are required to decide in each case whether the acquisition of additional right of way or the construction of retaining walls is more economical.

The high cost of retaining walls along long stretches of track, especially in track elevation or depression work, leads to special studies regarding modification of the various types of plain and reinforced concrete walls with a view to economy. Figs. 73 to 83 illustrate various types of retaining walls for track elevation and depression work. These studies have been made in the engineering department of the Chicago, Milwaukee & St. Paul Railroad, C. F. Loweth, chief engineer, J. H. Prior, assistant engineer.

An adaptation of the counterfort retaining wall to the design of bridge abutments is the U-abutment. Two parallel retaining walls are placed, not far apart, connected at the front by a wall forming the bridge seat. The counterforts are replaced by tie walls, which act in direct tension if wind is not considered.

The best known of foreign types is the Hennebique wall, which is shown in Fig. 84. The advantage of this type is the low cost of excavation, due to the narrow footing. Its disadvantage is the increased volume of concrete, the raised heel slab carrying less earth and being wider to insure the same stability as an ordinary counterfort retaining wall.

Wherever an architectural treatment is required it is advisable to divide the front surface in panels. By the use of more or less elaborate details of the paneling, also by pilasters, coping and batter, the appearance can be improved, which is very desirable in city work. It is also to be recommended to treat the entire surface or parts of it by bush hammering, or similar methods, insuring a better looking surface finish.

A few examples of modern practice in retaining walls are shown in Figs. 64, 65, 85, 86.

The walls, Figs. 64 and 65, have been discussed before. For Fig. 85 we are indebted to Mr. A. M. Wolf's article on "Concrete Practice," in the March, 1913, issue of "Railway Engineering."

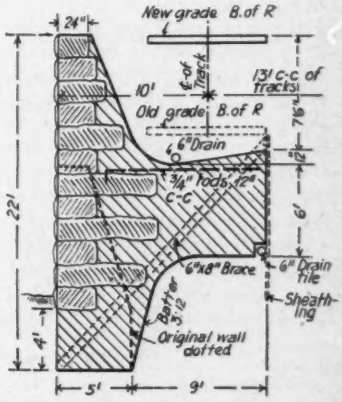


Fig. 65. C. & N. W. Hammerhead Wall.

Fig. 86 shows a very interesting retaining wall which has been built in connection with the terminal improvement work in Seattle, Wash. We are indebted to Engineering News of 1912 for this example which is remarkable for various features, not the least among them being the thickness at the top of only 8 ins.

Cost. Many considerations entering into a discussion of the relative economy of various types of retaining walls cannot be touched upon at all in this article, on account of lack of space. A general discussion of the elements of cost, however, will be attempted with a view to aid the designing engineer in arriving at the best and most economical solution in each given case.

Conditions affecting the cost of labor and materials involved in the construction of retaining walls differ very widely in different sections of the country. It can, however, be said that the cost of the finished structures does not differ as widely as might be expected. The explanation of this important fact is the presence of certain factors which tend to equalize and stabilize the cost of building operations. To quote an example, in the Pacific coast states the cost of labor is higher than in the central and eastern states, also the cost of materials, especially such materials as are not manufactured in the Far West, is considerably higher. Yet the cost of the finished concrete in place is little, if at all, higher than in the eastern localities,

*This is the fourth and last of the series of articles on this subject.

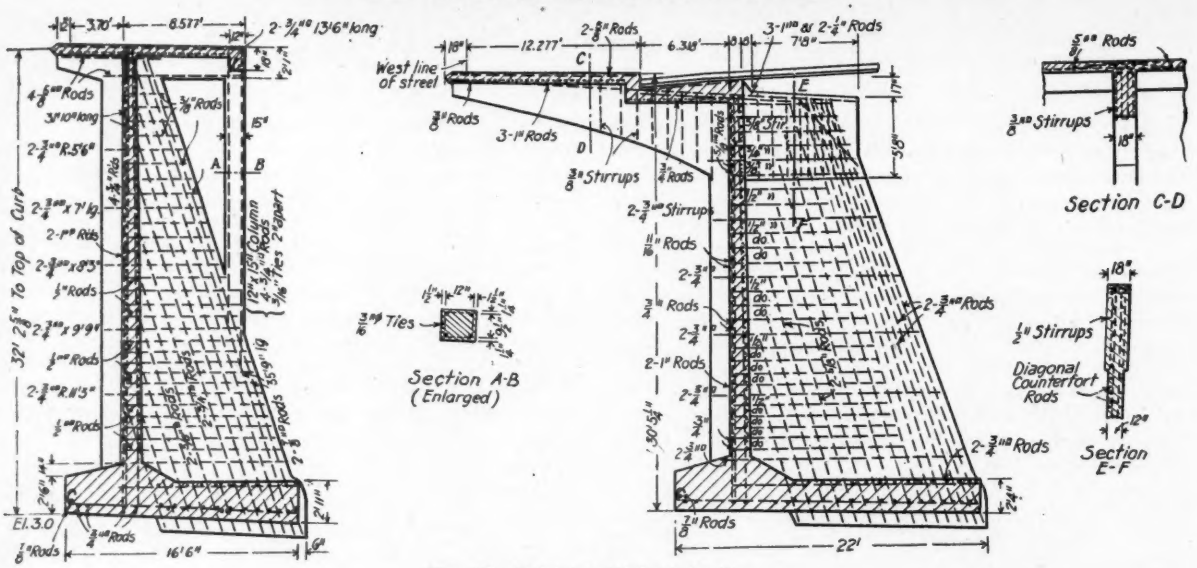


Fig. 86. Retaining Wall at Seattle.

because one of the most important elements of the cost of concrete work—i. e., the cost of wood for forms and centering—is much lower than in the East. In the South, the higher cost of certain materials is counteracted by the cheaper southern labor. If we compare the records of the cost of various concrete structures in various sections of the country, we find very small variations. It is, indeed, possible to use average figures for preliminary estimates, such as would give a sufficiently accurate basis for the comparison of the various types of retaining walls.

After the cost of plain concrete per cubic yard, including all labor, material and forms, has been estimated on the basis of local conditions, it is a very simple matter to arrive at a fair comparison of the cost of different types of plain concrete walls. In fact, the cost of plain concrete walls varies almost proportionately to the yardage of concrete. This is not quite true, as excavation, back filling and other elements change this proportion. If we want to compare the cost of plain concrete types with reinforced concrete types, then it is much more difficult to arrive at a fair basis for the comparison. The opinions of railroad engineers and contractors differ very widely regarding the maximum economical percentage of reinforcement, the minimum thickness of walls, and on other matters having a bearing on this subject. Generally speaking, a reduction of the thickness of a wall calls for increased cost of labor and forms. It would, however, be very difficult to determine the economical limits of these variations. Many railroad engineers and contractors maintain (without having been able to prove their contention by experiments and records) that the economical limit of a reinforced concrete wall is 1 foot 6 inches, or even 2 feet. At the same time many other railroads are building retaining walls with a minimum thickness of 1 foot or less, without reporting any trouble or excessive expense.

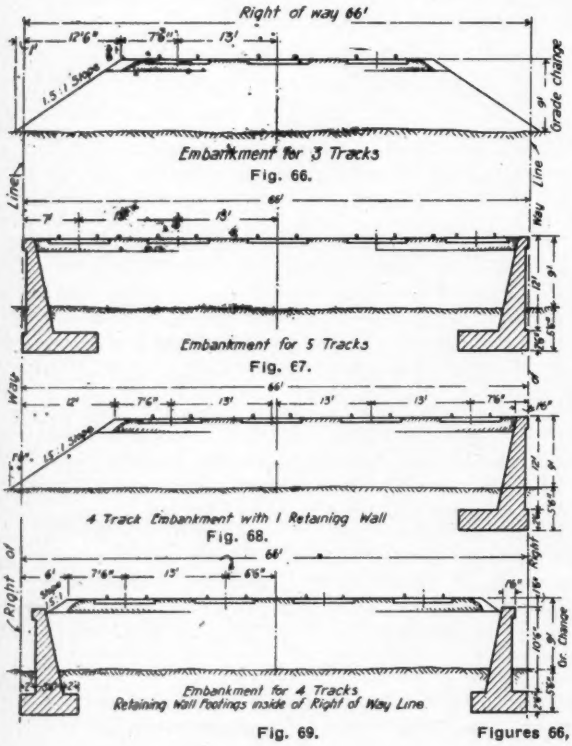
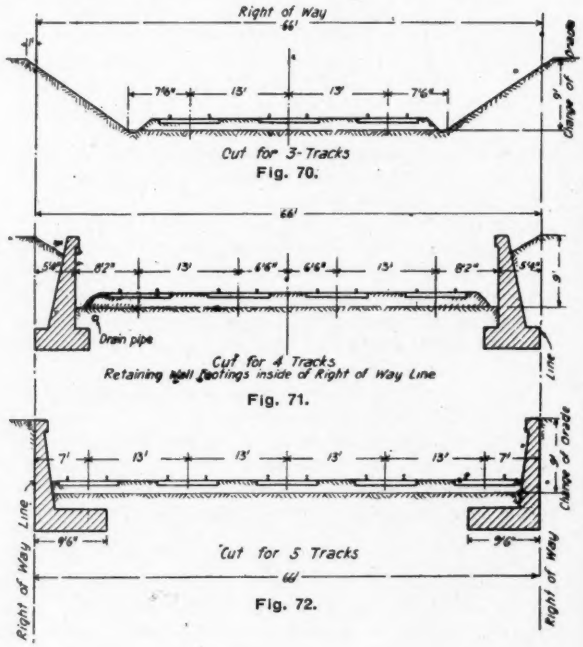
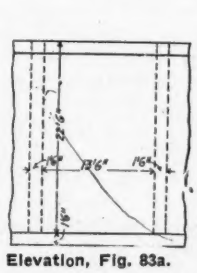

Right of way 66'
Embankment for 3 Tracks
Fig. 66.
Embankment for 5 Tracks
Fig. 67.
4 Track Embankment with 1 Retaining Wall
Fig. 68.
Embankment for 4 Tracks
Retaining Wall Footings inside of Right of Way Line

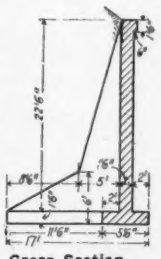
Fig. 69.

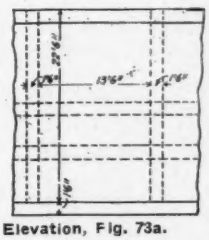


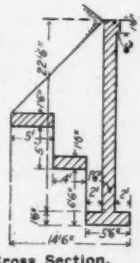
Figures 66, 67, 68, 69, 70, 71, and 72.

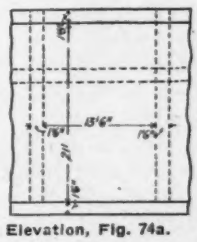
This question needs comprehensive investigation before it can be considered finally settled. In the meantime any conclusions regarding the economy of reinforced concrete retaining walls, drawn from assumptions based on personal preference only, should be offered to the professional public more as personal opinions, not with the same finality as the results of tests, which have been verified repeatedly. Mr. J. H. Prior's paper on the "Design of Bridge Abutments," which deals largely with the economy of various types of abutments, omits to mention this principle as one of the most important elements of the economy of retaining walls, abutments and related structures. Abutments retaining the earth fill of the embankment are special cases of retaining walls, and the same economic principles are underlying both groups of structures. Mr. Prior's figures are based on reinforced concrete retaining walls of 1 foot 9 inches thickness, which seems to be excessive for low walls, and which seems unfair to the counterfort type of retaining walls or abutments. The omission of a comprehensive treatment of the principles underlying the determination of economical wall thicknesses must be criticised. Caution should

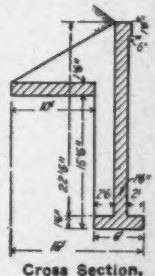

Elevation, Fig. 83a.

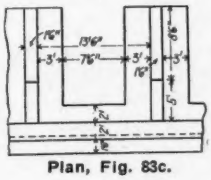

Cross Section, Fig. 83b.

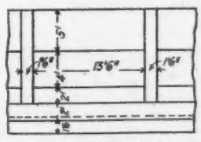

Elevation, Fig. 73a.

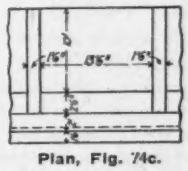

Cross Section, Fig. 73b.

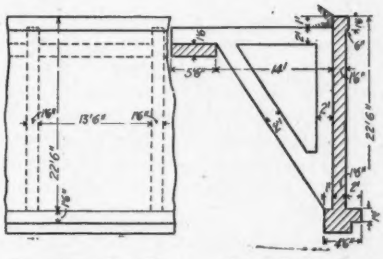

Elevation, Fig. 74a.

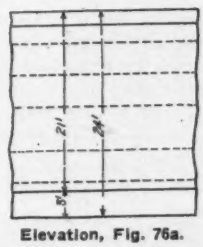

Cross Section, Fig. 74b.

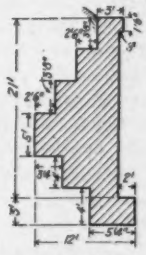

Plan, Fig. 83c.

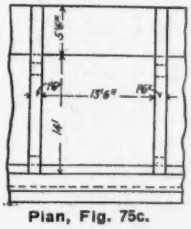

Plan, Fig. 73c.


Plan, Fig. 74c.

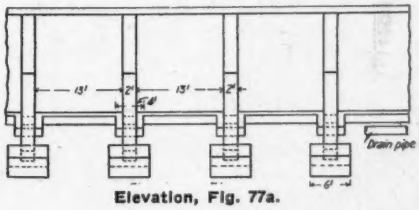

Elevation, Fig. 75a. Cross Section, Fig. 75b.

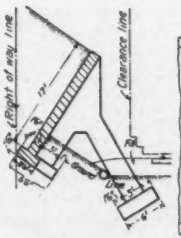

Elevation, Fig. 76a.

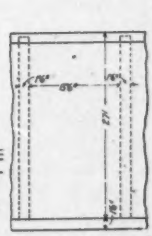

Cross Section, Fig. 76b.

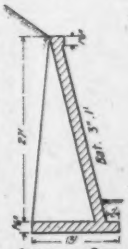

Plan, Fig. 75c.

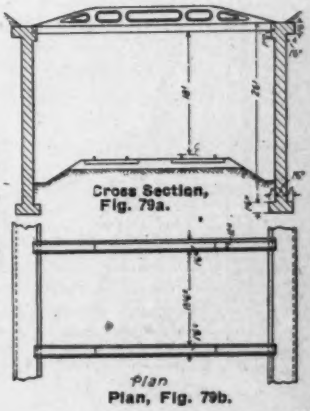
Plan, Fig. 76c.

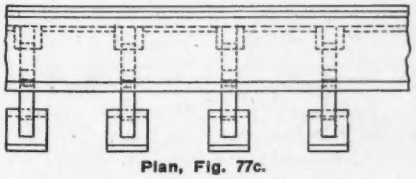

Elevation, Fig. 77a.


Cross Section, Fig. 77b.

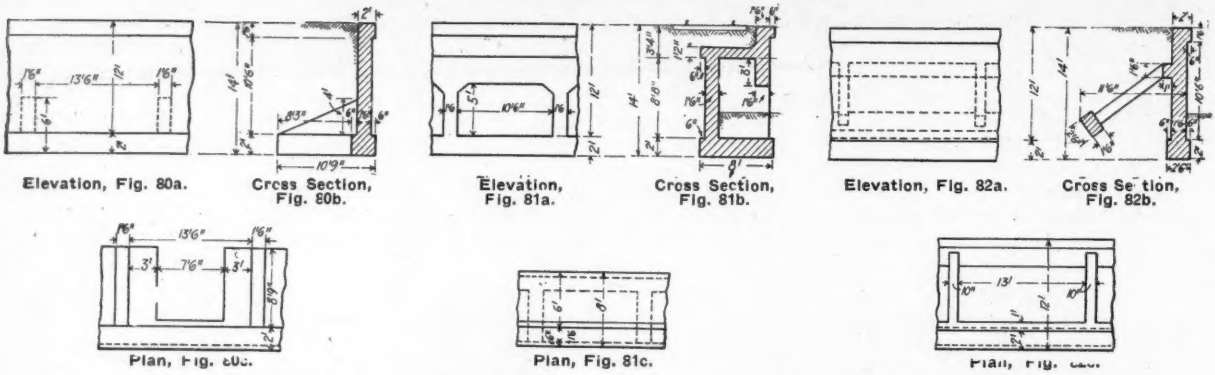

Elevation, Fig. 78a.


Cross Section, Fig. 78b.


Cross Section, Fig. 79a. Plan Plan, Fig. 79b.


Plan, Fig. 77c.

Plan, Fig. 78c.



Elevation, Fig. 80a. Cross Section, Fig. 80b. Elevation, Fig. 81a. Cross Section, Fig. 81b. Elevation, Fig. 82a. Cross Section, Fig. 82b.

Plan, Fig. 80c. Plan, Fig. 81c. Plan, Fig. 82c.

therefore be observed in using the tables and diagrams by designing engineers.

At the same time the present writer does not pretend to offer a final solution for this problem. The comparison of cost of the various types of retaining walls is based on certain assumptions as set forth later, and they do not hold good for conditions which call for essentially different proportions of concrete to steel and to forms.

Another important element entering into a general discussion of cost and estimating is the degree to which inefficiency of the construction and supervision should be taken into account. It seems most reasonable to base an estimate neither on the most favorable, nor on the most unfavorable, but on average conditions. Wherever the cost of actually built structures is made the basis of an estimate it is necessary to ascertain whether or not the local conditions existing were responsible for exceptionally low or exceptionally high cost, and also whether or not items were included in or excluded from the cost record, which would have to be considered differently in the estimate. In other words, the law of averages prevails in this as in most other cases, and the average of a large number of cost records makes a better basis for estimating than one or two cost records, which may be high or low for local reasons.

The following prices have been assumed in estimating the various types of retaining walls.

Excavation, $1.00 per cubic yard.

Plain concrete in footings, $5.00 per cubic yard, including material, labor and forms.

Plain concrete in neatwork, $7.00 per cubic yard, including material, labor and forms.

Reinforced concrete in footings, $8.00 per cubic yard, including material, labor and forms, excluding steel.

Reinforced concrete in neatwork, $9.00 per cubic yard, including material, labor and forms, excluding steel.

Reinforcing steel, 2¾ cents per pound, including bending and placing.

The minimum thickness of reinforced concrete wall has been assumed at 1 foot 3 inches.

The walls have been proportioned for a low pressure of about 2 tons per square foot, assuming no surcharge acting on the earth fill.

The comprehensive stress in the concrete does not exceed 600 lbs. per sq. in., the tensile stress in the steel does not exceed 15,000 lbs. per sq. in.

Based on these assumptions and prices the various types have been estimated for heights from 10 feet to 36 feet, and the results plotted in the diagram, Fig. 87.

It will be seen that for low heights the plain concrete walls are more economical, and that with increasing height the reinforced concrete walls become more economical. This statement seems to be backed up by many publications on the same subject. It cannot be questioned that the reinforced concrete retaining walls are constantly gaining in favor with designing engineers. Aside from their economy for moderate and greater heights, they are to be recommended because of the absence of cracks if carefully constructed, and also because of their broader field of application.

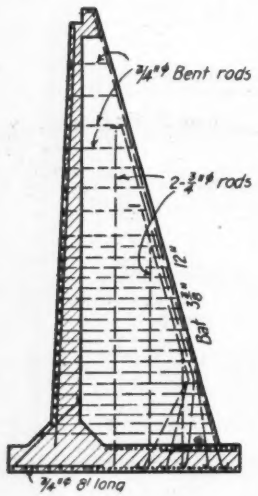


Fig. 85.

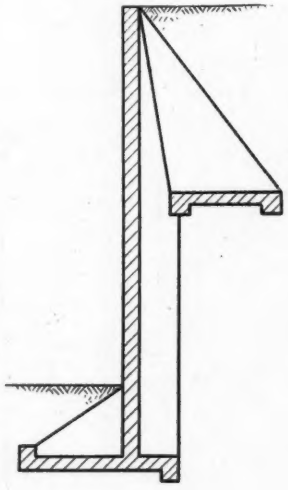
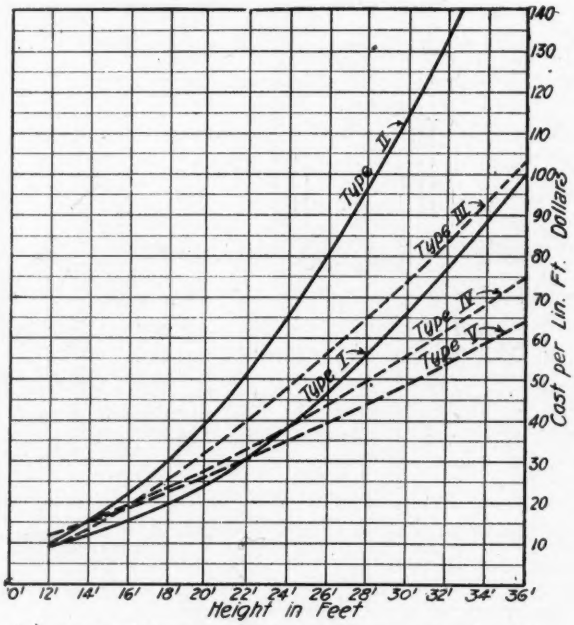


Fig. 84.



Comparison of Approximate Cost of Types I to V per Lin. Ft. for Toe Pressure about 2.0 Tons.

Fig. 87.

RAILWAY MAIL PAY.

Russell Perkins.

The necessity of meeting constantly increasing expenses, while not being permitted to increase their earnings proportionately, is creating a situation which is becoming decidedly serious for the railroads of the United States. The burdens which have been placed upon the railroads by the Government through laws and regulations, compliance with which requires the expenditure of large amounts of money, are numerous and well known, but one of the greatest injustices to which they are obliged to submit is in connection with a branch of the services with which railroad men as a whole are least familiar, and that is the transportation of the mails.

Agitation of the question of railway mail pay, now going on, invites the query as to what kind of a contract the railroads have with the Postmaster General for the transportation of the United States mails.

Individual firms or corporations entering into an agreement arrange the things each will undertake to do, and make the obligations of each party to the contract appear in signed and accepted form with reasonable understanding.

The Post Office Department, however, when establishing a railroad mail route, demands a company signature to an agreement of which the following is an extract:

"In case the Post Office Department authorizes the transportation of mails over this line, or any part of it, the railroad company agrees to accept and perform the service upon the conditions prescribed by law and the regulations of the Department." If the railroad offers any objection or modification, no voice in what the agreement should be is permitted.

Delay or refusal to sign and accept the agreement results in any enquirer about the establishment of mail service being informed by the Post Office Department that the railroad company will not perform the service, and thus public prejudice is created and pressure is brought to bear to force an agreement.

Every four years the required quadrennial contract or agreement contains the following:

"The company named below agrees to accept and perform mail service upon the conditions prescribed by law and the regulations of the Department applicable to railroad mail service."

Regulations are made from time to time during the period covered by the contract, and are often inconsistent with the law, but nevertheless are construed and enforced as having the force and effect of law and often with great injustice to the railroads, when in fact they are only orders of the Postmaster General. There are many injustices in connection with mail transportation to which the railroads are obliged to submit, but perhaps the worst feature is the fact that contracts for transportation of mails are made to cover four-year periods. The attitude of the Post Office Department toward paying for this service is expressed by the Postmaster General as follows:

"The compensation for carrying the mails is fixed for a four-year period on the basis of the average daily weights ascertained at the last quadrennial weighing on respective mail routes. You are no doubt aware of the fact that such an adjustment both in the practice of the Post Office Department and in contemplation of the law fixing the rates is regarded as full pay for all increases in weights of mails during the contract period for four years after adjustment."

It is a matter of general knowledge that the natural increase in the mails from year to year for a period of four years is considerable, and since the establishment of the Parcels Post it has been abnormal. This is shown by the postoffice records of the principal mail order centers, which have been published from time to time. Notwithstanding the constant increase in mail carried for four years, no additional compensation is paid the railroads, but they are obliged to continue to perform the service for four years for compensation based on the weight of the mail at the beginning of the period.

The rate of pay is low and the railroads should at least be paid for their services on the basis of the amount of mail actually carried. This could be more nearly arrived at by a yearly weighing and contract.

Railroad employees in train and station service who come in direct contact with the handling of mail know that this condition exists, but owing to the isolation of the mail service from the general business of the railroads, a large proportion of the railroad employees do not. It is a matter which is or should be of equal interest to employees of all departments, and they should be interested in having a change brought about, as the amount of revenue to the railroads involved is very large, and more earnings are necessary to assist in obtaining better pay and safer and better working conditions. If railroad men would demand, through those whom they help to place in office, that this injustice be remedied, much good might be accomplished.

Arrangements are being made for the construction of the depot and buildings for the shops to be established at Port Mann, B. C., by the Canadian Northern Pacific.

The Grand Trunk will commence the construction of 26 miles of tracks and will also erect without further delay a new station and a round house at Colborne, Ont. The original estimate of the work was $1,000,000.

The Boston & Maine has ordered 225 tons of structural steel for new shops at Mechanicsville, N. Y.

The Houston & Texas Central has acquired 250 acres of land about one mile south of Mexia, Tex., and preparations are being made for a terminal yard at that point. A six-stall engine house will be erected at once. This will later be enlarged to 30 stalls and a machine shop will also be added.

The Grand Trunk is planning to build a new passenger station and freight depot at Black Rock, N. Y. As planned at present, the passenger station will be built south of the track and abutting on the Niagara street subway, and the freight station will be built just opposite on the north side of the track. The passenger station will be about 150 feet by 40 feet, with a brown stone foundation and two stories of brick. The freight depot will be similar in size and general construction. The estimated cost of the two buildings is $75,000.

The Pennsylvania, it is reported, has prepared plans for a new $20,000 passenger station to be erected at New Castle, Pa.

The Canadian Northern Ry. has awarded contract to John McLeod & Son, Winnipeg, Man., for its $40,000 terminal depot at Edmonton, Alta.

The St. Louis Southwestern has begun work on a new 16-stall roundhouse at Texarkana, Tex.

The Canadian Pacific will build another addition to its passenger car repair shop at Toronto, Ont. The new building will be one story high and will be built of brick and concrete foundation. John Hayman & Son Company, London, Ont., have secured the concrete contract for this building, which will cost about $26,000.

The Atlantic Coast Line R. R. will erect a freight house two stories high, 50x225 feet, at Lakeland, Fla.

The Gulf, Colorado & Santa Fe, it is said, will spend from $8,000 to $10,000 for yard improvements at Alvin, Tex.

The Galveston, Harrisburg & San Antonio, it is reported, will spend about $14,000 in improving its freight facilities at El Paso, Tex.

The Louisville & Nashville has opened for use its new passenger station at Pensacola, Fla.

The Atchison, Topeka & Santa Fe is in the market for 30,000 tons of rails.

The commissioner of public works at Chicago will receive bids for a new bridge at Lake street, which will cost about $550,000. The plans call for a double-deck, trunnion bascule bridge, the upper level to be used by the Chicago & Oak Park Elevated.

The Chicago, Burlington & Quincy is inquiring for 50,000 tons of rails.

THE IMPERATIVE NECESSITY FOR GOOD ROADS TO AND FROM RAILWAY STATIONS.

To have convenient access to railway stations is a matter quite as important to the suburban or country homeseeker as frequency of trains. This means good roads, and it may be said that smooth, durable highways have done fully as much to develop certain sections as have the railroads themselves. The celebrated "Main Line" district of the Pennsylvania R. R. is an example, a locality that has long been famous for its good roads, in the establishment of which the late A. J. Cassatt, president of the Pennsylvania, was the moving spirit.

In this day of motor and truck traffic, miles shrink to yards as compared with the situation a decade or more ago. The rapidity with which a locality will develop is therefore tremendously influenced by the road conditions. Manifestly, then, it is good business and economy to build the best type of highway it is possible to obtain. Ordinary roads will not stand the stress of modern motor traffic. This is the consensus of opinion among road experts. The conviction is daily gaining ground that it is a sheer waste of money to put down the old-fashioned type of water-bound macadam highway, notwithstanding the fact that it answered admirably for horse and carriage traffic. The cost of maintenance is tremendous. The matter to determine is whether it be possible to build a highway not excessive as to first cost, and which will represent the minimum for upkeep cost. In considering the matter, bear in mind, however, that the wealthy suburban dweller does not, by any means, represent the most important factor in the case. There is the grower of truck and farm produce, and the suburban or country storekeeper with merchandise to be transported. Thus the subject covers all sections conveniently accessible to railroads so far as the mere matter of miles is considered. It is especially important to consider the farmer. Bad roads mean cessation of hauling during the greater part of the year and corresponding congestion of freight when conditions are favorable. Even during good seasons a spell of bad weather will mean empty cars for a period and congestion again when the highways become passable. Good roads that are good all the year round will result in more definite and stable conditions as to volume of traffic, while the prices farmers receive for produce will not fluctuate to extremes.

As a practical illustration of what has already been accomplished in the effort to solve the good roads problem, we present the following facts:

The Solution of the Road Problem.

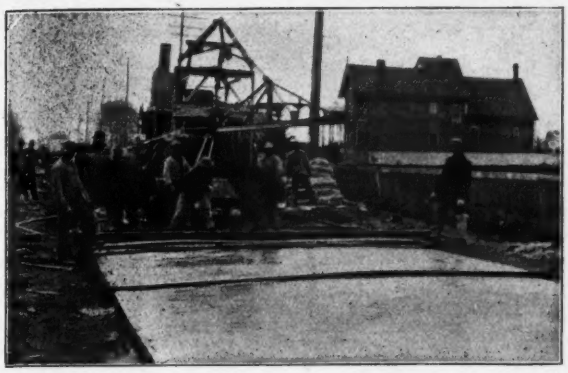
There has been evolved by the Board of Road Commissioners of Wayne County, Michigan, Edward N. Hines, Chairman, a highway that has cost for maintenance during the past five years less than $5 per mile per year. A striking illustration of the economic significance of this achievement is as follows: Let it be assumed that we are to build 500 miles of ordinary stone or macadam highway and 500 miles of the Michigan type of road, the work to be done at the rate of 100 miles a year during a period of five years, and that repairs will not be required on either type of road for two years. Beginning, then, at the third year, and estimating maintenance costs for the Michigan road at $25 per mile per year, which, it will be noted, is five times more than it has really cost, the total maintenance costs on 500 miles of this road would, at the expiration of seven years, be only $37,500. In the case of macadam, basing costs on the New York and New Jersey figures, which have exceeded $900 per mile per year, repair costs would reach the enormous total of $1,350,000.

This amazing difference ceases to be astounding, however, when the construction of the Hines type of road is explained. It is a simple proceeding, unattended with secrecy or patents, a precedent every community is at liberty to follow. It can best be explained in this way: Suppose we were to pour over a highway a molten mass of bronze, and that it could be so controlled as to settle into the required contour of a road some six inches thick. It would last forever. The stress of tons would be negligible. The Wayne County road builders poured over the previously shaped and rolled roadbed a wet and mushy mass of cement, sand and stone, which hardened into imperishable rock. Just before it hardened the surface was broomed from side to side to give a texture that keeps horses and motor cars from slipping. These roads can of themselves accumulate neither mud nor dust. They improve with age, a characteristic of well-made concrete known to every engineer and chemist.

Concrete Highway in Michigan.

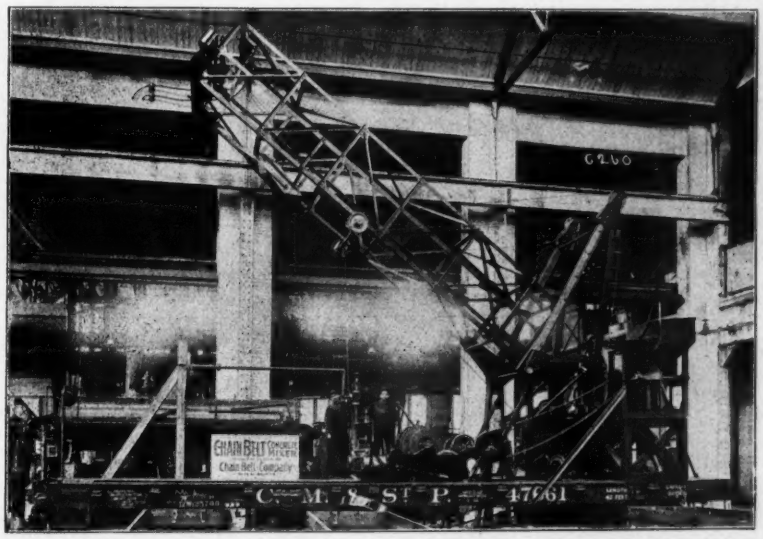
The Romans built roads that have lasted for centuries. Scientists discovered that their extreme durability lay in their binding material. Instead of holding their roads together with clay, rock-dust and other easily-displaced binding material, such as we use on macadam roads, the Romans used puzzolan, a form of cement that has also kept intact through centuries their wonderful buildings. The same principle governs the construction of the Michigan type of road. In Bellefontaine, Ohio, they tried cement as a binder eighteen years ago, notwithstanding its then high cost, and the result has been that the Bellefontaine road during that long period has cost only $25 per mile per year for repairs.

The figures given above are official. The average cost of road maintenance in the States of Massachusetts, Rhode Island, Connecticut, New York and New Jersey was over $800 per mile in 1912. In New York alone it exceeded $1,000 per mile. Accepting $900 per mile per year as a fair estimate of cost for the maintenance of important and much-used macadam roads, this annual outlay would represent interest on $18,000 at 5 per cent. Assuming the first cost of a macadam road to be $8,000 a mile, which is a conservative estimate on first-class macadam, roads of this character really represent an investment of $26,000 per mile. Under average conditions a good concrete road can be built for $12,000 and, as stated, actual experience has shown that upkeep costs are practically negligible.



Building a Concrete Road.

In an address delivered in the city of Pittsburgh in December, 1912, before an audience of engineers, architects and builders, Edward N. Hines, Chairman of the Commissioners who built the Wayne County roads, made the following statement:



Concrete Tower, Folded Over to Pass Under Obstructions.

"With more than 60 miles of concrete road in Wayne County, some of it in its fourth year, we have spent less than $300 on its surface for maintenance, and this is what makes this type of road the cheapest of all good roads.

"Woodward Avenue road, now in its fourth year, shows little or no signs of wear, and it is not built nearly so well as our lately constructed concrete roads. A conservative estimate of traffic on this road is that over 1,300,000 vehicles (more traffic than would go over an ordinary country road in twenty years) have passed a given point, without the development of ruts, holes or bumps and with the expenditure of next to nothing for surface maintenance."

If our taxpayers were stockholders in a perpetual manufacturing enterprise and found that its managers were spending $1,000 a year for repairs to every $10,000 machine when it could be done for less than $10 by the adoption of better machines at practically the same cost, the situation would correspond to the circumstances attending modern road improvement.

CONCRETE DISTRIBUTING TOWER MOUNTED ON FLAT CAR.

A method of concrete distributing has been worked out on the Bloomingdale road track elevation of the Chicago, Milwaukee & St. Paul Ry., which is somewhat out of the ordinary. The illustration herewith shows a steel folding tower which is mounted on a flat car, and can be moved about at will.

Movable towers have been used to some extent for concrete distribution, but mostly in connection with commercial buildings. Such towers, however, are not mounted on cars, nor are they so easily portable.

In the outfit shown the mixer, hoisting plant and tower are all mounted on the same car.

The equipment consists of a 25 H. P. horizontal boiler, a 20 H. P. horizontal double cylinder hoisting engine and a one-half yard chain belt concrete mixer, together with a folding steel tower, elevator bucket and steel chutes supported from the tower, that can readily be revolved through 180 degrees.

The retaining walls are of plain gravity section without piles. To concrete the footings, a half yard batch mixer is used, mounted on a flat car, and same readily dumps over end of car into a spout and the concrete is spouted directly into the footings. Hinged brackets have been put on the corners of this car at the mixer end to support the spout, so that same may be revolved through 180 degrees and the wet concrete deposited in its final position in the footing, necessitating very little shoveling. The aggregate for the concrete is being received in gondolas or coal cars, and runways placed on top of these cars and material wheeled direct from the cars to the charging hopper of the mixer.

Practically all of the labor cost connected with making concrete with this equipment consists in getting the aggregate to the mixer and spading and working it in the forms. The same engineer who runs the mixer operates the hoist, and of course it requires the usual number of men to handle the feed water valve, batch hopper, cement, etc. The plant is entirely self-contained and can be folded back onto a car so as to clear trolley wires, telephone wires or low bridges. The raising of the tower is accomplished by a jack tower or auxiliary tower with blocks and cables operated by the hoisting engine. To lower the tower, a snub line is given a couple of wraps around the winch head and by a slight pull the tower is raised just beyond the center of gravity; then, by the aid of a band friction brake the tower is readily laid down to a horizontal position, after which the auxiliary or jack tower, which is made of 4 x 6 timbers, can be folded down by hand or by a line over winch head of the engine.

Pouring Concrete With Portable Tower.

The apparatus was furnished by the Chain Belt Co., Milwaukee, in conjunction with W. B. Louer, Chicago. The track elevation work is in charge of C. F. Loweth, chief engineer, under whose supervision the plant described was designed.

NEWARK BAY BRIDGE BURNED AND RECONSTRUCTED.

On the night of Saturday, June 14th, the Pennsylvania Railroad's two-track trestle across Newark Bay, near New York harbor, was burned to the water's edge. A tremendously important piece of track—accustomed each day to convey hundreds of carloads of freight—was put out of commission.

Twelve and a half days later a new trestle bridge, temporarily replacing the former structure, was in service. It took 1500 men working day and night, backed up by all the resources of a great organization, to accomplish it.

The bridge was 5653 feet long—something over a mile; the draw itself was 264 feet long. Over it about 1600 freight cars passed daily, cars with food products, coal and iron, for New England and Long Island, and in return came cars loaded with the output of factories of that section.

Greenville, it might be added, is a highly important railroad settlement on the Jersey shore of New York harbor. Cars destined for New England and Long Island are floated from here to their connection with the New York, New Haven and Hartford and the Long Island Railroads. Coal for steamers and for export also gives the Greenville Yard much to do.

Fire, caused probably by sparks from a locomotive, started on one of the two parallel bridges—one owned by the Pennsylvania Railroad and the other by the Lehigh Valley—about 1200 feet from the Jersey shore, and, fanned by a land breeze, worked its way rapidly to the Greenville shore. About 3500 feet of both bridges were burnt.

Ruins of Newark Bridge.

Once it was seen that the fire would put the bridge out of commission, the first thing to be done was to provide for an alternative freight route to New England. Traffic was sent north from Trenton over the Pennsylvania R. R. to Belvidere, N. J., where connection was made with the Lehigh and Hudson R. R., which crosses the Hudson River on the Poughkeepsie bridge. Some 5000 cars were handled to and from New England this way. The Hudson River docks of the Delaware, Lackawanna and Western and the Erie R. R. were also placed at the disposal of the company. So promptly were these arrangements made that the hundreds of cars of perishable freight went through to their destinations without delay.

The engineers did not wait for the fire to abate its fury before they had all their plans perfected for re-establishing connection between Newark and Greenville.

It was decided that each road should build one track, thereby giving a two-track bridge when both had finished. The Lehigh Valley bridge builders started at the west end of the bridge, while the Pennsylvania men worked in the opposite direction.

The following equipment and material was used: fourteen pile drivers, thirteen marine derricks, twenty-one scows, two tugs, six catamarans, five air compressors, three water boats, two derrick cars, two locomotive cranes, three switching engines, two teams of horses, 3,000,000 feet of lumber and 1500 men. This was but a starter. As the work progressed much other equipment was added.

The special physician who was on duty every minute remarked afterward that such was the attention paid to every detail when the camp was organized that there proved to be little need for the services of a physician. There was no case of illness, and but a few minor accidents. The only serious accident happened to one laborer, who had an arm broken.

Not a little trouble was experienced with the steel trucks and underframes of the cars of a potato train which had fallen in the bay. Many of them had lodged between the piles, and it was necessary first to remove them before sawing off the burned piles at the water level, for on top of these burned piles were to be laid transverse sills a foot thick, and on these a new trestle of timbers. As the bridge now stands the track level is about twenty-six feet above high water.

Another obstacle the engineers met at first was the thousands of feet of steel rails which lay twisted among the charred piles, but speedy work was made of it when two hundred men were set to work breaking joints so that the rails could be handled with some ease.

A force of 1000 men was kept working in the day, and 500 at night, and an average of ten feet of bridge was built every hour.

A complete electric light plant was established at the western end of the burned bridge, so that wires could be carried out over the burned portion. On the eastern end connection was made with the Pennsylvania R. R.'s electric light plant at Greenville yard, and with the Public Service Company's lines. Both arc and incandescent lamps were supplied from the eastern end, so that the burned portion of the bridge was brilliantly lighted for night work. Telephone lines were run to the middle of the bridge to facilitate communication between the various parts of the work.

The burned portion of the Newark Bay bridge cost originally $130,455. To replace it will cost approximately $295,000. The $164,545 difference practically represents what the Pennsylvania spent for speed. The total loss to the company was $295,000—for the former bridge was not an old one; it was built in 1904 and was a modern structure in every way.

J. B. Fisher, superintendent of the New York division Pennsylvania R. R., was in entire charge of the reconstruction of the Newark Bay bridge.

The Butte, Boise & Winnemucca, according to press reports, has started construction work on a line from Boise, northeast to Butte, Mont., to a connection with the Gilmore & Pittsburg, and from Boise southwest to Winnemucca, Nev., to a connection with the Western Pacific. The contract was awarded to J. W. Monarch.

The California-Oregon & Eastern is planning to build from Grants Pass, Ore., southwest to Crescent City, Cal., about 100 miles. William Loftus, Portland, Ore., is president of a construction company that has been organized to build the line. The grading work is to be started at once on the first section of 10 miles from Grants Pass to Wilderville, crossing the Rogue and Applegate rivers.

Twenty Years Ago This Month

Twenty years ago this month the Roadmasters' Association of America met in Chicago, September 12, 13 and 14, 1893, on the occasion of the eleventh annual convention. The president of the association, H. W. Reed, master of roadways S. F. & W. Ry., presided over each session. Sixty-eight new members were elected. At the election of officers Mr. Reed was re-elected president; C. E. Jones, roadmaster C., B. & Q., first vice-president; J. O. Walker, roadmaster P., T. & A., second vice-president; W. W. Sharpe, roadmaster S. F. & W., secretary and treasurer.

Operations were commenced by the Baltimore & Ohio to reballast with crushed stone the entire line between Pittsburgh and Cumberland, Md., the Pittsburgh division having been made a part of the main line.

The Northwestern Track & Bridge Association held its annual meeting in St. Paul, Minn., September 8, 1893.

The employes of the Cleveland, Cincinnati, Chicago & St. Louis voted to accept a ten per cent decrease in wages, owing to the financial depression. A strike had been threatened.

In broad daylight, September 7, 1893, a most remarkable collision between passenger trains occurred on the Pennsylvania Lines West. Fourteen men were killed in the wreck, which was due to a lap order, the dispatcher admitting in a manly confession that he forgot.

W. C. Brown, general manager of the K. C., St. J. & C. B. Ry., learned that an attempt would be made to rob the night passenger train of that road, September 23, 1893. He made up a dummy train of similar appearance and sent it out on the time of the regular train. It was held up and the would-be robbers were all killed or captured by the guards. The regular train followed forty-five minutes later without incident.

[Editor's Note.—Scarcely a week in 1893 passed without news of a train robbery. There were usually more or less successful and Mr. Brown's action was, while characteristic of the man, about the only decisive move toward putting an end to the outrages during the year.]

J. W. Kendricks was appointed general manager of the Northern Pacific. This was an important instance of the promotion of an engineering department officer to the head of the operating department.

One of the worst disasters of the kind occurred when a Boston & Albany passenger train went through the Westfield river bridge, August 31, 1893. It appeared that the bridge was being strengthened by the addition of riveted plates on the girders, and that a number of important plates were temporarily weakened by cutting the old rivets. H. C. Ives, assistant to the vice-president, Atchison, Topeka & Santa Fe Ry., was one of those killed.

The Johnson Railroad Signal Co. completed a large interlocking plant for the Illinois Central at 69th street, Chicago. H. M. Sperry, general agent for the manufacturers, superintended the installation.

In forty-eight hours ending September 26, 1893, the Pennsylvania carried 15,722 passengers into Chicago.

The Alva & Northwestern is said to have been organized in Oklahoma for the purpose of constructing a line about 80 miles in length from Alva, Okla., to connect with the Chicago, Rock Island & Pacific at Bucklin, Kan.

The Charlottesville Interurban, it is said, has completed surveys and the route decided upon for a line from Charlottesville, Va., southwest about 15 miles to Alberene. Financial arrangements are not yet complete, but it is probable that the line will be built.

Personals

Operating

George W. Coffin has been appointed general manager of the Atlantic Southern Ry., office at Atlanta, Ia.

As announced in the August issue of *Railway Engineering*, C. Murphy has been appointed general superintendent of the Canadian Pacific Ry., at Winnipeg, Man. He entered the service of this railway in 1883 as operator, was made chief operator in 1885 and later chief dispatcher. He was appointed acting superintendent in 1899, superintendent at Chaplean, Ont., in 1900, and transferred in the latter capacity to North Bay, Ont., in 1902, and to Montreal in 1903. He was appointed relieving general superintendent in 1908, and general superintendent at Montreal in 1908. In 1910 he was appointed general superintendent of transportation at Montreal, holding that position until being appointed general superintendent of the Manitoba division as noted above.

C. C. Walker, formerly general superintendent of transportation, has been appointed assistant to general manager of the Chesapeake & Ohio Ry., office at Richmond, Va. E. P. Goodwin, formerly inspector of transportation has been appointed general superintendent of transportation, office at Richmond, Va., succeeding Mr. Walker. W. R. Hudson has been appointed general superintendent at Covington, Ky., having jurisdiction also over the Chesapeake & Ohio Ry. of Indiana, succeeding J. P. Stevens. Mr. Stevens has been appointed general superintendent at Richmond, Va. E. J. Ford has been appointed superintendent at Richmond, Va., succeeding H. H. Morris, transferred to Ashland, Ky., as superintendent, succeeding W. L. Booth.

W. L. Booth, formerly superintendent of the C. & O. Ry., has been appointed superintendent of the Chesapeake & Ohio Ry. of Indiana at Peru, Ind.

E. S. Koler, formerly assistant general manager of the Chicago, Burlington & Quincy R. R. at Chicago, has been appointed assistant general manager, lines west, office at Omaha, Neb.

J. B. Carothers, formerly general superintendent, has been appointed assistant to general manager of the Cincinnati, Hamilton & Dayton Ry., office at Cincinnati, O.

M. A. Neville, formerly superintendent of the Big Four Ry., has been appointed general superintendent of the Cincinnati Northern Ry. at Van Wert, O. He began railway work as an engineer on a field corps of the Peoria & Eastern Ry., in June, 1899, and in October was appointed assistant engineer. On March 1, 1901, he was appointed engineer maintenance of way, and then superintendent, holding this position until his appointment as general superintendent of the Cincinnati Northern Ry., effective August 1.

B. C. Byers has been appointed superintendent of the Cleveland, Cincinnati, Chicago & St. Louis Ry., at Indianapolis, Ind. J. V. Kennedy has been appointed superintendent at Cleveland, O., succeeding E. M. Costin, promoted.

A. B. Spencer has been appointed general manager of the Crosbyton South Plains R. R., office at Crosbyton, Tex.

W. S. Martin, formerly assistant general manager, has been appointed general manager of the Denver & Rio Grande R. R., office at Denver, Colo.

H. C. Bell has been appointed general manager of the Detroit, Toledo & Ironton Ry., office at Detroit, Mich. He entered railway service with the Lake Shore & Michigan Southern Ry. in 1881, and in 1888 he entered the service of the C. C. C. & I. Ry., which was consolidated with the Big Four Ry. in 1889. He remained with the latter railway until 1901, when he was appointed chief clerk in the traffic department of the Detroit, Toledo & Ironton Ry., and held successively the positions of

assistant general freight agent, general freight agent, and general freight and passenger agent. His appointment as general manager was effective July 1.

W. F. Kaderly, formerly superintendent of motive power, has been appointed general superintendent of the Georgia Southern & Florida Ry., office at Macon, Ga.

As announced in the July issue of *Railway Engineering*, F. S. Elliott has been appointed general superintendent of the Great Northern Ry. at Great Falls, Mont. He entered railway service as telegraph operator on the Chicago, Rock Island & Pacific Ry. in Iowa in 1883 and was employed on various western lines in capacities of telegraph operator, station agent, train dispatcher, assistant superintendent, division superintendent and assistant general superintendent. He entered service of the Great Northern Ry. as dispatcher in 1894.

As announced in the August issue of *Railway Engineering*, John C. Sesser has been appointed superintendent of the Kalispell division of the Great Northern Ry., with headquarters at Whitefish, Mont. He was born August 20, 1873, at St. Joseph, Mich., and was educated at Michigan State College, and at Lehigh University, receiving the degree of civil engineer. From June, 1896, to February of the following year he was draftsman with the Allentown Rolling Mill Co., Allentown, Pa., and then entered railway service. He was consecutively instrument man and resident engineer on the Chicago & North Western Ry. until April, 1898, and then to December of the following year was resident engineer of the Union Pacific R. R. In November, 1900, he became chief engineer of the Olaa Plantation, Olaa, Hawaii. From June, 1901, to November of the following year he was resident engineer of the Chicago, Milwaukee & St. Paul Ry. and then, to May, 1903, was chief engineer of the Iowa & St. Louis Ry. He was resident engineer and engineer of maintenance of way of the Missouri district of the Chicago, Burlington & Quincy R. R. from May, 1903, to April, 1907, and then to December, 1909, was vice-president of the W. K. Kenly Co., and contracting engineer of the Walsh Construction Co. In December, 1909, he was appointed assistant engineer maintenance of way of the Great Northern Ry., at St. Paul, Minn., which position he held at the time of his recent appointment as superintendent.

W. J. Helmick has been appointed superintendent of the Gulf, Texas & Western Ry. at Jermyn, Tex.

J. H. Palmer has been appointed superintendent of the Hawkinsville & Florida Southern Ry., office at Ashburn, Ga.

As announced in the June issue of *Railway Engineering*, E. W. Bowans has been appointed general superintendent of the International Rys. of Central America, office at San Miguel, El Salvador. He was born at Greencastle, Ia., February 18, 1864, and at the age of four years his parents moved to Monroe, Ia., where he lived on a farm until he was 18, when he learned telegraphy at Fairmount on the C., R. I. & P. Ry. In 1883 he went to Texas and worked for the S. P. Ry. in the capacities of operator, clerk and agent at various stations. In 1899 he went to Mexico as brakeman on the Mexican Central Ry. and was soon promoted to the position of conductor and worked as such for a number of years. In 1901 he was made trainmaster for the National of Tehuantepec Ry. in Mexico, located at Rincon Antonio, and in 1902 was made superintendent of the same lines. He resigned in 1903 and was made trainmaster for the Interoceanic Ry. at Mexico City, resigned that positon in 1905 and was made trainmaster of the Vera Cruz al Pacifico at Tierra Blanca; in 1906, he returned to Mexico City as general yardmaster for the Interoceanic Ry. of Mexico. In 1907 he was made terminal superintendent for the National Lines of Mexico at Mexico City. In 1908 he was made terminal superintendent at Vera Cruz, transferred in 1909 to Queretaro, in signed from the National Lines of Mexico in December, 1911, and in September, 1912, went to Guatemala and entered the service of the International Rys. of Central America as general yard master at Port Barrios, and remained for two months, when he was made chief inventory clerk in taking annual stock; after this was finished he was appointed general superintendent as noted above, effective February 16, 1913.

G. Hopkins has been appointed acting general superintendent of Morgan's Louisiana & Texas R. R., and the Louisiana Western R. R., office at New Orleans, La., succeeding H. W. Sheridan, effective July 29.

As announced in the August issue of *Railway Engineering*, M. Dailey has been appointed vice-president and general manager of the Muscatine North & South Ry., office at Muscatine, Ia. He was born in Galesburg, Ill., in 1865, began railroading as locomotive fireman on the Chicago, Burlington & Quincy R. R. at Creston, Ia., at the age of 16, and was later promoted to locomotive engineer. In the spring of 1888 he went to the Chicago Great Western Ry. at Des Moines, Ia., and remained with them twenty-three years as locomotive engineer, traveling engineer, trainmaster, master mechanic and superintendent. In 1911 he went with the Bellingham Bay and British Columbia R. R. at Bellingham, Wash., as superintendent of machinery, and in 1912 was appointed superintendent of the M., O. & G. Ry. at Denison, Tex. His appointment as general manager was effective July 15.

E. J. Parrish, formerly superintendent of telegraph, has been appointed superintendent of the New York, Chicago & St. Louis R. R. at Ft. Wayne, Ind., succeeding E. K. Blair, promoted.

T. W. Saul has been appointed assistant superintendent of the Oregon-Washington R. R. & Navigation Co., at Portland, Ore., succeeding W. M. Jaekel.

B. C. Byers has been appointed superintendent of the Peoria & Eastern Ry. at Indianapolis, Ind., succeeding M. A. Neville, promoted.

J. A. Gordon, general superintendent of the Pere Marquette R. R., has been transferred from Detroit to Grand Rapids, Mich. W. C. Hurst has been appointed general superintendent at Saginaw, Mich.

F. L. Brendel, superintendent of the Western Maryland Ry., has been transferred from Baltimore to Hagerstown, Md., succeeding H. H. Berry, resigned. R. M. Johnson has been appointed superintendent at Baltimore, Md., succeeding Mr. Brendel.

Engineering

Charles C. Schnatterbeck, for the past three years secretary to the assistant engineer of surveys of the Baltimore & Ohio R. R., has been promoted to chief clerk of the timber preservation department, effective August 6. Previous to his employment by the B. & O. R. R. Mr. Schnatterbeck was a prominent trade journal editor, having been on the editorial staff of "The Engineering and Mining Journal," of New York, and other leading technical publications. He has also been a special investigator in the employ of the United States government, and has written a great deal on economic subjects. In his new position Mr. Schnatterbeck will be given the opportunity to study the possibilities of developing the timber treating industry with particular reference to the conservation of the railroad timber supply.

W. Osborne has been appointed engineer of maintenance of way of the Atlantic Southern Ry., office at Atlantic, Ia.

C. H. R. Howe has been appointed division engineer of the Baltimore & Ohio R. R. and the Cincinnati, Hamilton & Dayton Ry. at Cincinnati, O., effective July 15. He was educated at Worcester Academy, Mass., and Dartmouth College, Hanover, N. H., and began engineering work with the city of Worcester in 1901. He entered the service of Boston & Albany R. R. in 1903 as rodman, served through grades of inspector, transitman and field engineer in charge of grade crossing elimination, terminal and dock improvements at East Boston, Mass., until 1906, and then entered employ of Baltimore & Ohio R. R. as assistant in office of chief engineer. In February,

1909, he went to Panama as general draftsman in the service of the Isthmian Canal Commission, and was made chief draftsman in October, 1909, and remained in the Canal Zone till 1911, when he re-entered the service of the B. & O. R. R. in the chief engineer's office. He was appointed assistant division engineer in December, 1911, and transferred to the Indianapolis division, C., H. & D. Ry., in May, 1913, as acting division engineer, which position he held until appointed division engineer, as noted above.

P. J. Watson, Jr., assistant engineer Chicago & Alton Ry., has been transferred from Atlanta to Bloomington, Ill.

E. L. Sinclair has been appointed resident engineer of the Chicago, Milwaukee & St. Paul Ry., at Marion, Ia. He has been connected with this railway since 1897 in the capacities of locating engineer and assistant engineer. This position is a new one necessitated on account of the large amount of construction work under the jurisdiction of resident engineer W. E. Wood.

J. J. HESS, Assistant Engineer Maintenance of Way, Great Northern Railway.

John Osmond, formerly resident engineer, has been appointed assistant engineer of the Chicago, Milwaukee & St. Paul Ry., at Tama, Ia., succeeding Mr. Sinclair. R. E. Boyle has been appointed resident engineer at Cambridge, Ia., succeeding Mr. Osmond.

W. C. Davis has been appointed assistant engineer of the Cuba R. R., at Camaguey, Cuba.

J. J. Hess has been appointed assistant engineer maintenance of way, of the Great Northern Ry., office at St. Paul, Minn. He began railway work as water boy on the Chicago, Rock Island & Pacific Ry., and went to the Atchison, Topeka & Santa Fe Ry., where he served for fifteen years in various capacities from extra gang foreman to general roadmaster of the Gulf, Colorado & Santa Fe Ry. In 1897 he entered the service of the Great Northern Ry. as assistant roadmaster and was promoted to roadmaster. He was placed in charge of reconstruction work for one season and then returned to the Chicago, Rock Island & Pacific Ry. as roadmaster, was appointed trainmaster and yardmaster, and finally again roadmaster. In 1905 he entered the service of the St. Louis South-Western Ry. as assistant roadmaster and in 1907 he returned to the Great Northern Ry. as roadmaster and was appointed trainmaster in 1911, and was again made roadmaster temporarily, which position he held until his promotion to assistant engineer maintenance of way, as noted above.

E. A. Whitman has been appointed assistant engineer of the Minneapolis, St. Paul & Sault Ste. Marie R. R., office at Minneapolis, Minn.

F. K. Bennett has been appointed division engineer of the Missouri, Kansas & Texas Ry., at Muskogee, Okla., succeeding C. E. Wright.

S. L. Wonson has been appointed assistant bridge engineer of the Missouri Pacific Ry., office at St. Louis, Mo. G. B. Bagley has been appointed assistant engineer at Kansas City, Mo., succeeding G. W. Payne, who has been transferred to the valuation department at St. Louis.

I. Romo has been appointed division engineer of the National Rys. of Mexico, at Mexico, D. F.

H. J. Rhodes has been appointed acting resident engineer of the New Orleans & North-Eastern R. R., at Vicksburg, Miss. He succeeds A. A. Woods, who has been transferred to New Orleans, La., as resident engineer, succeeding J. C. Hough, deceased.

C. A. Drake, assistant engineer of the New York, New Haven & Hartford R. R., has been transferred to Olneyville, N. Y., in charge of grade crossing elimination.

Effective July 15, J. H. Nuelle was appointed chief engineer of the New York, Ontario & Western Ry. He has been in the service of this railway as assistant engineer from January, 1907, to September, 1911, as principal assistant engineer from September, 1911, to January, 1912, and as engineer maintenance of way since January, 1912, till the date of his recent appointment as chief engineer, noted above, with office at Middletown, N. Y.

C. H. Fenstermacher and John Field have been appointed valuation engineers of the Norfolk & Western Ry., reporting to C. S. Churchill, chief engineer and chairman of valuation committee, both with offices at Roanoke, Va.

C. H. Fenstermacher began railway work as chainman on the Pennsylvania R. R. in 1883 and was later appointed rodman. He was draftsman in the chief engineer's office of the Norfolk & Western Ry. from 1887 to 1889, and draftsman in the office of the engineer maintenance of way from 1889 to 1891. In 1891 he was appointed assistant engineer in charge of maintenance of way, Shenandoah division. From 1895 to 1899 he was draftsman and assistant engineer on the New York Central & Hudson River R. R., at Rochester, N. Y. From 1899 to 1903 he was chief draftsman in the office of the chief engineer of the Norfolk & Western Ry., and from 1903 to 1913 he was assistant engineer on maintenance, construction and office work. His appointment as valuation engineer at Roanoke, Va., was effective July 1.

W. F. Curlin, division engineer and roadmaster of the Pan-American R. R., has been transferred from Tierra Blanca to Tonala, Chis., Mex.

W. D. Wiggins has been appointed valuation engineer of the Pennsylvania Lines West, office at Pittsburgh, Pa. W. E. Guignon, assistant engineer, has been transferred from New Castle, Pa., to Chicago, Ill., succeeding A. S. Bland. H. J. Shaw, assistant engineer, has been transferred from Louisville, Ky., to New Castle, Pa., succeeding Mr. Guignon. J. L. Taylor, Jr., has been appointed assistant engineer at Louisville, Ky., succeeding H. J. Shaw.

As announced in the August issue of *Railway Engineering*, James Edward Johnson has been appointed division engineer of the Pere Marquette R. R., at Saginaw, Mich. He was born August 24, 1883, at Tipton, Ind.; graduated from Ohio State University, and entered railway service as rodman with the C., H. & D. Ry., February 1, 1905. From May 1 to September 1, 1905, he was with the L. S. & M. S. Ry., as rodman and instrument man, and then went with the C., C., C. & St. L. Ry. as masonry inspector. January 15 to September 1, 1906, he was employed on an engineering corps of the Vandalia R. R., and then went with the Missouri Pacific Ry. as assistant engineer. He was appointed division engineer of the Hocking Valley R. R. February 1, 1907, and division engineer of the

Pere Marquette R. R. September 15, 1912. From November 15, 1912, to May 15, 1913, he was assistant eastern sales agent for the P. & M. Co. He was reappointed division engineer on May 15, 1913, as noted above.

Bridges and Buildings

C. E. Powell, formerly supervisor of bridges and buildings, has been appointed general inspector of bridges of the Chesapeake & Ohio Ry., office at Richmond, Va. T. H. Allen has been appointed supervisor of bridges and buildings at Richmond, Va., succeeding Mr. Powell.

H. P. McKey has been appointed supervisor of bridges and buildings of the Cuba R. R., at Camaguey, Cuba.

J. E. Clement has been appointed superintendent of bridges and buildings of the Detroit, Toledo & Ironton Ry., at Springfield, O., succeeding Jacob Confer, retired.

A. B. Ashmore has been appointed supervisor of bridges and buildings of Morgan's Louisiana & Texas R. R. and the Louisiana Western R. R., at Lafayette, La., succeeding A. J. Ross, retired.

J. E. Hood has been appointed supervisor of bridges and buildings of the Northern Pacific Ry., at Duluth, Minn., succeeding R. E. McFarlane, on leave of absence.

J. Robinson, supervisor of bridges and buildings of the Pere Marquette R. R., has been transferred from Traverse City to Grand Rapids, Mich. J. P. Wood has been appointed supervisor of bridges and buildings at Saginaw, Mich. His territory used to be under the supervision of C. F. Weir, who retains the Canadian portion, with headquarters at St. Thomas, Ont.

The locks of the Panama Canal are nearly complete as far as concrete work is concerned, the total amount of concrete in place early in June being 4,461,597 cu. yds. Of this amount 2,037,621 cu. yds. are in the Gatun locks; 921,179 cu. yds. at Pedro Miguel and 1,502,797 cu. yds. at the Mariflores locks.

After extensive tests and experiments the Board of Water Supply of New York City in charge of the construction of the largest municipal waterworks in the world, has decided to use reinforced concrete roof tiles.

These tiles are to be placed on the metal framework of the roof, which is entirely encased in concrete. The main or pan tile have a lug at one end which fits over the purlins; these tile have about 54 in. x 23 in. of exposed surface. A rib is cast on one side to fit over the adjoining tile, forming a weatherproof joint when packed with jute or yarn and elastic cement.

The concrete for these tile is mixed 1 part cement to 2½ or 3 parts of sand. Tile are not to be less than 1 in. thick, and to have a ribbed surface texture with integral or surface coloring. The reinforcement consists of wire mesh and steel bars of small section, at least ¼ in. from the surface. At 28 days the tile must sustain a central load of 600 lbs. on a 35 in. span.

Crushed Stone Screenings as Fine Aggregate for Concrete

A GREAT amount of crushed stone screenings is used every year in concrete work in place of sand. Much of the concrete made in this manner is as good or even better than concrete of the same character and mixture where sand is used as the fine aggregate; but this cannot be cited as being the fact in all cases. It should be remembered that to obtain good concrete, stone screenings should pass the requirements of good sand; that is all dust and fine powder should be removed.

If the screenings are obtained from trap, quartz, hard limestone and granite rocks, crusher run can in general be used on account of freedom from dust. Crusher run limestone screenings such as is ordinarily obtained in this locality (Chicago) generally contain altogether too much dust and powder to make good concrete with the ordinary proportions. When screenings containing much dust are used, more cement should be added to the mixture to fill the voids and thereby preserve the strength of the concrete; thorough mixing of the materials before adding water is very essential when such fine aggregate is used, this precaution preventing the tendency of screenings to "ball up" or become lumpy when water is added. The period of mixing should in general be longer when screenings are used, in order to have the concrete of uniform consistency.

Failure to observe these facts has been the cause of the use of much poor concrete in various classes of structures. Wearing surfaces containing crushed limestone screenings in general give very poor service, the surface formed being too soft to stand the abrasive action to which it is subjected. Unless rigid inspection is insured, the use of crushed run limestone screenings, especially for reinforced concrete work, should be discouraged.

Water for Concrete

PRACTICALLY all specifications for concrete work call for clean, pure water to be used for all concrete, thus recognizing the importance of this precaution. In city work where water is obtained direct from the mains, little or no attention need be paid to its character. On railroad bridge work, however, the matter is entirely different, for in general the structures are located far from any such handy sources of supply, and water must be hauled in tank cars or pumped from the river or stream over which the bridge is being built; thus the examination of the water is a necessity.

In pumping water from lakes or streams, in nine cases out of ten, the suction end of the hose or pipe is placed on the bottom and as a result more or less mud and suspended matter is mixed with the water and the concrete mixed therewith considerably weakened. When pumping water from a stream, the suction end of the line should be so placed as to be at some distance from the bottom or so protected as to prevent the stirring up of mud by the suction. Muddy and slimy water should never be used, for the mud and slime coat the aggregate and preclude the possibility of a uniform and strong mixture. Poor concrete in railroad structures is in more cases due to dirty and impure water than any other one thing; the blame, however, is in general laid on the cement.

Before work is started on any structure, the engineer in

charge should make a physical examination of the water to be used. In general, if it is fit for washing it will be suitable for concrete. If manufacturing wastes, sewage or other filth is discharged into the stream at points above the bridge site, a chemical examination of the water should be made. Water containing acids or alkalis should in no case be used, it being cheaper in the long run to haul pure water from some other source than to shorten the life of the structure by using that which is near at hand. The man in charge of concrete work should remember that water for mixing demands as much attention as water for drinking.

Internal Temperature Changes in Concrete Arches.

THE abstract of a bulletin of the Iowa State College, on the internal temperature changes in concrete arch bridges, appearing on another page, is of interest and value to the railroad bridge engineer, in that it gives a basis for assuming temperature variations to be used in railroad arch design.

Although the results given are from experiments on solid fill spandrel highway arches, it is safe to say that the temperature changes in railroad structures of the same type are no greater, except in special cases, than those indicated by the tests. This is because of the relatively larger sections used in railroad arches. The same statement, however, does not hold good for railroad arches with transverse open arch spandrels, for such structures are much more susceptible to temperature changes than those covered by an earth fill and for this reason a greater temperature variation should be allowed for in design.

The tests mentioned, indicate that a temperature variation of at least 40° F. each way from a normal temperature of no stress should be used in design of solid fill spandrel arches. The usual practice in design is to allow a variation of 20 degrees for spandrel filled arches and 45 degrees for an open spandrel arch. Since, when compared with the test data, the former assumption is only one-half that shown by test to exist, it is reasonable to believe that the latter assumption is somewhat low and that a variation of 50 degrees each way from the normal would be more nearly correct for open spandrel and ribbed arches.

The extra cost entailed by providing for this increased variation in temperatures is very small as compared with the total cost and can be considered well spent if the unsightly cracks so often found near the springing line, caused by excessive temperature stresses, are eliminated.

We should like to hear from our readers who are interested in this matter, as to what assumption they make for temperature variation in design and the results obtained. If enough of such data can be gathered, a valuable table can be made up and published for the benefit of all concerned.

The Canadian Pacific will build an electric line from Hamilton, Ont., to Niagara Falls. By constructing this electric line through the Niagara peninsula, the Canadian Pacific will be in a position to handle traffic direct from Hamilton to Buffalo on its own right of way, instead of operating, as at present, over the lines of the Toronto, Hamilton & Buffalo and the Michigan Central. The Canadian Pacific may undertake, also, the construction of a line from Toronto to Hamilton, to avoid operating over the Grand Trunk tracks.

REINFORCED CONCRETE FENCE POSTS.

The Chicago & Northwestern Ry. has a line of fence along the Boyer River between Denison and Missouri Valley, Iowa, made up of an aggregate number of 5,000 reinforced concrete posts. The original fence with wooden posts was very difficult to maintain on account of the tendency of the posts to float. Accordingly it was decided to use concrete posts and a plant for their manufacture was built at Dunlap, Iowa. The equipment consists of 265 D. & W. 7-foot line post molds and 25 8-foot molds for end posts. The posts were made of a 1:2:4 mixture of concrete and reinforced by a ⅛ by ⅝ in. steel bar 6 ft. long. Five thousand posts were made by three men at a cost of 18.3 cents each for line posts and 53 cents for end and brace posts. The wages paid were 16½ and 17½ cents per hour. This fence has given excellent service and has not required repairs.

The monthly bulletin issued by the Universal Portland Cement Co. contains interesting illustrated descriptions of the varied uses of cement in construction work. The August bulletin is especially interesting, describing and illustrating some new reinforced concrete coal pockets, bridges and buildings recently built in various parts of the country.

Under the latter heading the description of large flat slab buildings built for Sears, Roebuck & Co. on the Akme System of Girderless Floor Construction gives an indication of the adaptability and popularity of flat slab construction to warehouse construction.

Every engineer should receive this bulletin monthly, each issue containing much valuable information. This Bulletin will be mailed to you regularly on request of *Railway Engineering*, Manhattan Bldg., Chicago.

The Chicago, Ottawa & Peoria has under contemplation the construction of an extension of its line to Seatonville, Bureau county, Ill. H. E. Chubbuck, Peoria, Ill., is vice-president and general manager of the company.

It is reported that citizens of Jefferson City, Mo., are trying to induce the Chicago, Rock Island & Pacific to build a branch line to their city. The St. Louis-Kansas City line of the Rock Island is 25 miles south, but a spur leaving the main line near Henley and extending to the Dustless coal mines brings the road within 19 miles.

It is said that the city of Corinth, Miss., and Hardin county may issue bonds to assist in financing the proposed Corinth & Northeastern. This line as planned will extend from Corinth to the Tennessee River and Hamburg, Tenn., about 22 miles.

The El Paso & Southwestern, it is said, will shortly take steps toward constructing a line from Tucson to San Diego, Cal.

The Kettle Valley, it is reported, jointly with the Great Northern, will build the unfinished link across the Hope mountains from the Coquehalla summit to Hope, B. C., on the Frazer river, 60 miles. Bids will be called for immediately. The Kettle Valley will build and operate the section, both systems sharing the expense and running rights.

The Greenville & Knoxville, according to reports, has purchased about 100 acres of land at Cap Creek Gap, lying partly in South Carolina and partly in North Carolina. The Greenville & Knoxville is to connect up with the proposed extension of the Knoxville, Sevierville & Eastern.

The Illinois Central is going to double the capacity of its shops at Paducah, Ky. It will erect new buildings and new machinery.

The Ogden, Lewiston & Northern has filed articles of incorporation with the secretary of state, Boise, Idaho. The capital stock is $100,000 and the company's principal place of business is Logan, Utah. It is proposed to construct a road from Ogden, Utah, via Aron, Paradise, Hyrum, Wellsville, Millville, Providence, Logan, Hyde Park, Smithfield, Richmond and Lewiston, through Fairview to Preston, Idaho, a distance of 80 miles.

MORRIS COUNTY TURNPIKE ARCH AT HOPATCONG, N.J., D. L. & W. R. R.

By A. M. Wolf, C. E.

When the Slateford-Hopatcong cut-off of the D. L. & W. R. R. is mentioned one thinks at once of those splendid concrete structures, the Delaware River Viaduct and the Paulin's Kill Viaduct. The magnitude and beauty of these structures overshadow and distract attention from the smaller structures of which there are many. All of these bridges, both overhead highway and railroad, are of a high standard of engineering and architectural design. One of these structures, which is very attractive on account of the rusticated surfaces, is the 40-foot skew span arch over the Morris County turnpike in the Musconetcong Fill, near Hopatcong, N. J., built in 1910.

Design.

This circular segmental arch carries three tracks and is placed on a skew of 60 degrees with the center line of tracks, the length of barrel being 74 feet 5 inches. The arch ring is 2 feet 9 inches thick at the crown, 6 feet 7⅝ inches thick at the spring, and has a rise of 12 feet, the total clearance at the centerline of roadway being 25 feet.

The structure was designed for Cooper's E-50 loading with impact in accordance with the following formula:

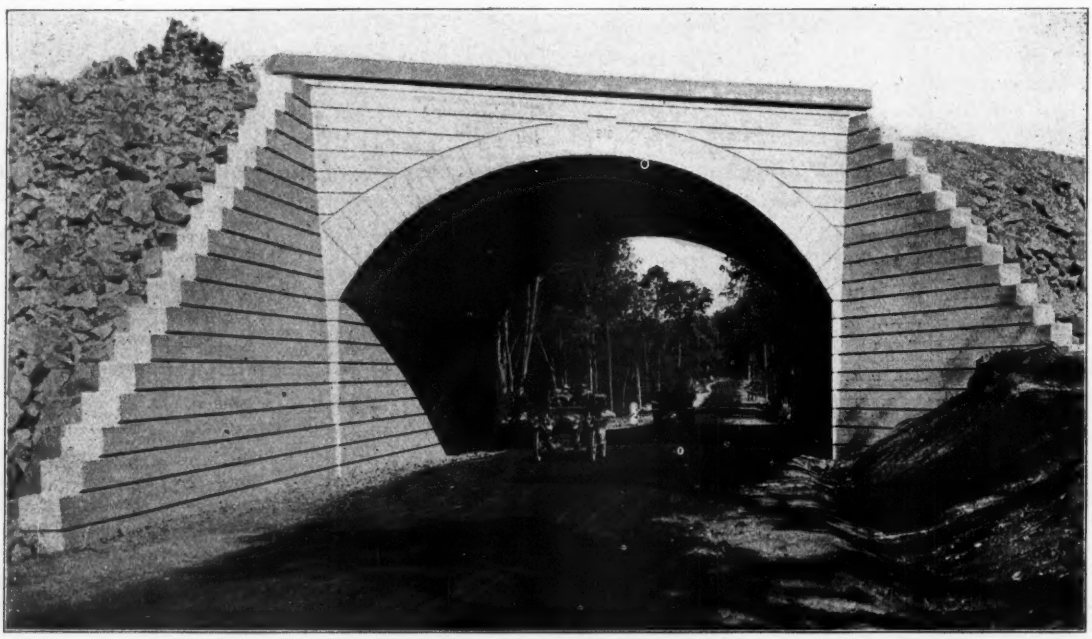
$$\frac{\text{Impact}}{\text{Live Load}} = \frac{\text{Live Load}}{\text{Live Load plus Dead Load}}$$

The live load was assumed as spreading over a 13 ft. width of arch ring and the fill as acting vertically. The fill over this arch is not very deep, but in greater depths the same assumption is made with the live load spreading through the fill on a slope of ½ to 1 from each end of tie. The live loading now being used by the D. L. & W., in the design of similar structures, is 60,000 pounds on each of four axles on 5 ft. 6 in. centers.

The arch ring was analyzed for three different conditions of loading, viz.: (1) Live load over entire span; (2) live load over half span; (3) dead load only, and so proportioned that the line of pressure is everywhere within the middle third, thus producing no tension, excepting that which would obtain due to temperature changes. The latter is taken care of by the reinforcing steel in plane of extrados and intrados. The analysis was made on the basis of a skew span, that is on a section parallel with the center line of track, and was built accordingly. By keeping the line of pressure within the middle third for this ring and loading, the compressive stresses were kept much lower than is the usual practice of this road, having a maximum of 300 lbs. per square inch not including temperature stress.

Details of Design.

The abutments are of class C plain concrete of a 1:3:5 mixture with large stones embedded, and are designed so that the maximum pressure of the toe is 5¼ tons per square foot. The bottoms of footings are at least 4 ft. below the surface, and deeper where the conditions demanded, in order that a safe bearing value of 5½ tons per sq. ft. could be used. Abutment faces are vertical and the backs are sloped so that the width at the top of footings is 22 ft. 6 in., the footings being 3 ft. thick with 1 ft. projections at the face and 1 ft. 6 in. at the rear. The height from top of footing to the springing line is 15 ft. The skewbacks are serrated or sawtoothed, as shown in the accompanying detail, making the bearing surfaces of the joint normal to the lines of thrust from the arch.



Morris County Turnpike Arch, D., L. & W. R. R.

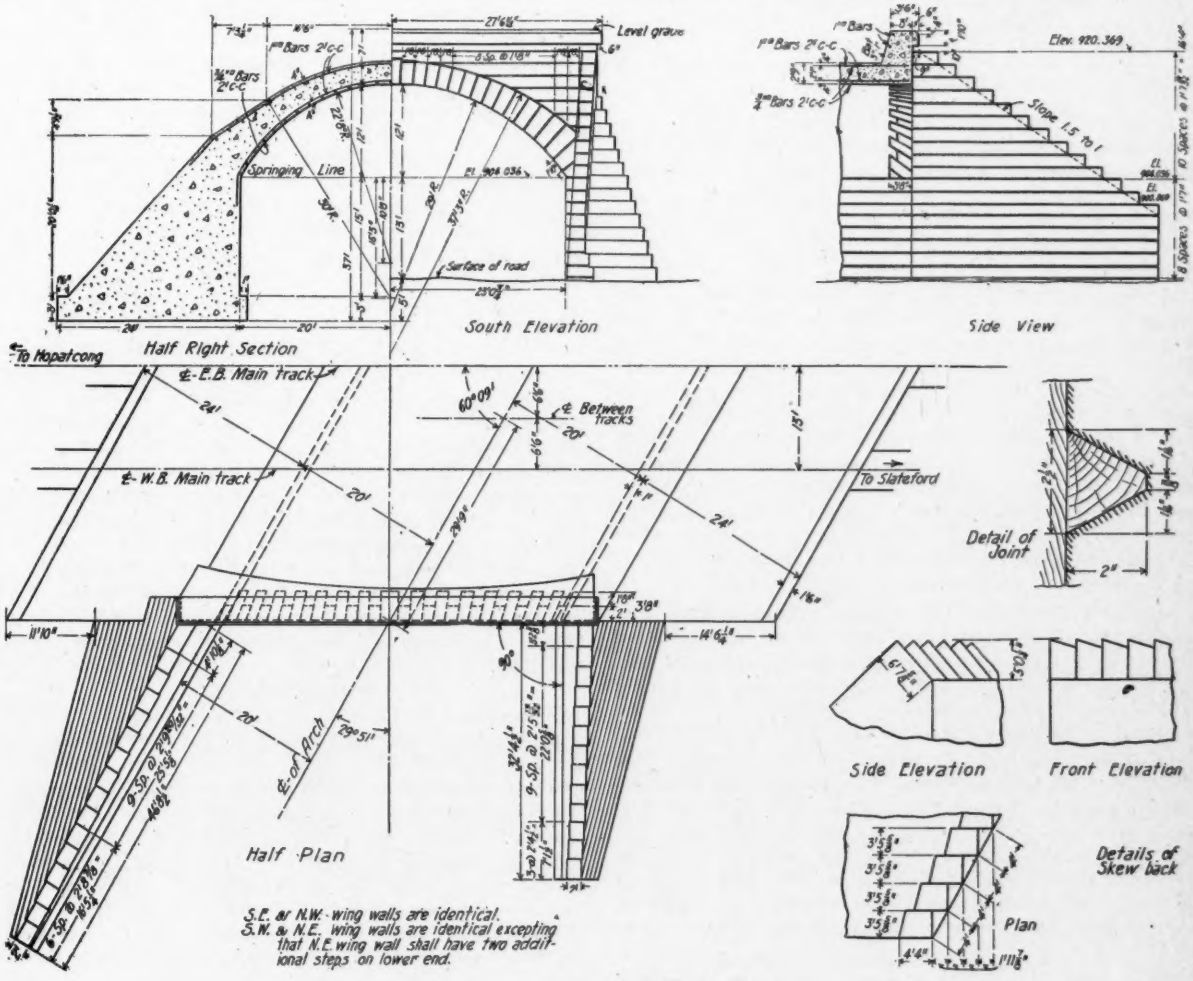
The wing walls are of the plain gravity type, composed of class C concrete, with stepped backs and a face battered at ¾ in. to 1 ft. One wing wall at each side of the bridge is parallel with the face of the abutment, while the other makes an angle of 29 degrees 51 min. with the line of abutment face; these latter wings are 32 ft. 9 in. long, while the former are 48 ft. 2 in. and 52 ft. 4 in., respectively. The tops of the wings are 2 ft. wide and stepped so as to form a slope equivalent to 1½ to 1. The height above footing at the point of connection with the abutment is 31 ft. 4 in. and the base width normal to the face of wing is about 16 ft., or over 0.5 of the height for the long walls, and 14 ft. or 0.45 of the height for the short walls. The backs of walls are built in steps 1 ft. 8 in. high with 6 in. projections at the rear. Wing wall footings are 3 ft. deep and project 1 ft. beyond neatlines.

The curve of the arch ring is a segment of a circle with an intradosal radius of 22 ft. 8 in. and an extradosal radius of 30 ft. The arch ring is reinforced longitudinally with 1 in. square bars, 2 ft. centers, 4 in. from extrados and intrados and ¾ in. square bars, 2 ft. centers, transversely just below and above the longitudinal bars in extrados and intrados, respectively. All bars were lapped at least 40 diameters at splices. The longitudinal bars in the arch ring lap with stub bars of equal size placed in the abutment so as to project for half their length. These bars

in the extrados are 10 ft. long, while those in the intradosal plane are 8 ft. long. Class B concrete, a 1:3:5 mixture, was used in the arch ring.

The spandrel or parapet walls retaining the fill over the arch ring have a width of 3 ft. under the coping which projects 6 in. beyond the vertical face of wall. Parapets have a back batter of 3 in. to 1 ft. and are designed as plain gravity walls. Five

There can be no denying that the appearance of the structure is greatly improved by the method of surface treatment used, the rusticated surface effectually hiding all horizontal construction points and breaking up the surface so that the form-marks are practically unnoticeable. The cost of the structure was increased very little by this rusticating of the surface, while the beauty of the bridge was greatly enhanced thereby.



Details of Morris County Turnpike Arch.

longitudinal bars (1 in. squares) are used in the parapet to prevent the formation of cracks. Three of these bars are in the top of coping and the other two are near faces of wall just below coping. The coping is 1 ft. 10 in. deep and the outer edge has a 4 in. bevel. Tops of parapets are 4 ft. 3 in. above the crown of arch, with the base of rail 3 ft. 11 in. above this, making the fill at the crown about 8 ft. deep. Class A, or concrete of a 1:2:4 mixture, was used in the copings, and class B in the remainder of spandrel walls.

Quantities.

Fourteen and one-half tons of steel were used in this structure and the concrete required, amounted to about 3,220 cubic yards.

Surface Treatment.

The showing faces of parapets, abutments and wings have horizontal coursing joints or scorings 1 ft. 8 in. centers. The upper line of the arch ring is delineated by a similar false joint and the arch ring is marked off into voussoirs or ringstones on radial lines, extending back on soffit in lines normal to the face. At the crown, the date plate gives the appearance of a keystone. These joints, a detail of which is given, are 2 in. deep and 2½ in. wide at the face and ⅜ in. at the back.

The arch was designed and built under the direction of Mr. G. J. Ray, chief engineer; Mr. F. L. Wheaton, engineer of construction, and Mr. T. Burke, contractor. We are indebted to Mr. A. B. Cohn, concrete engineer, for data and illustrations used in this article.

The Oakwood & Trinity River Southern recently incorporated to construct a 50-mile line from Oakwood, Tex., southward to a connection with the International & Great Northern, is about ready to take bids for construction.

The Oklahoma, New Mexico & Pacific has let a contract for construction to Wm. Kenefic Construction Co., Kansas City, Mo., and grading is now under way. J. L. Hamon, Lawton, Okla., president of the railway, is quoted as saying that material for 100 miles of line has been bought.

An organization, it is reported, has been made and preliminary survey agreed upon for a railroad from Rayville via Pioneer to Lake Providence, La., about 40 miles.

The Pointevant & Favre Lumber Company is considering the construction of a 20-mile railroad from its timberlands at Florence and Pearl river to its mill at Mandeville, La.

FIREPROOF RAILROAD SECTION TOOL HOUSES.

Part I—General.

Wooden tool houses which in the past have been standard on nearly all railways, are in themselves of no great physical value, but the tools stored therein are in general worth many times the cost of the building and in case of fire the loss on "contents" is the main item to be considered. For this reason a fireproof tool house is not a "luxury" but rather a "necessity," and it is safe to say that the time is not far distant when wooden tool houses will be very little used, except on minor roads.

In the early days when all railroad structures were more or less temporary, the wooden or frame tool house answered the purposes admirably, but nowadays when the tendency is toward permanent structures, the concrete tool house should, in every case, be given the preference over structures of a less permanent nature where this feature is embodied in all other structures.

A frame structure is constantly in need of repairs, painting and other items of expense in order to keep it in fit shape to house tools. A concrete tool house properly built will require practically no maintenance whatever, with the possible exception of the roof, and even this portion can be so constructed (as will be shown later) as to not require maintenance. The total cost of a concrete structure is but little more than its first cost, while that of a frame house is the first cost plus the maintenance charges, which, after a few years, become a considerable item. Thus, when all things are taken into consideration the expenditure of larger sums for permanent buildings is justifiable, since the maintenance is a minimum and practically no sinking fund is required for the replacement.

Another distinct advantage of the concrete tool house is its sanitariness. A frame structure after a few years becomes a fine breeding place for vermin of all kinds, and once such a building becomes infested it is next to impossible to get rid of the pests. The cracks and crevices in floor and walls form excellent hiding places for vermin and even if steps are taken to clean the place, it cannot readily be done on account of the difficulty in reaching all points. In a concrete tool house the condition is entirely different, the very nature of the material being of a solid and homogeneous character, free from joints and crevices within which vermin may collect. When it is desired to clean a building of this type it can be done quickly and thoroughly with water or compressed air, the unbroken surfaces aiding materially in the rapidity and effectiveness of this work.

The erection of a tool house of concrete does not in general require the use of any skilled labor except a carpenter or two (and they need not be first class men as would be required to build a frame structure) and a foreman in charge of the work. By using metal wall forms as are now being used extensively for plain wall work the cost of erection can be cut to a minimum and the speed of construction will be a maximum. If a standard design is adopted a set of steel forms can be purchased and used over and over, thus cutting the cost of form work, which in concrete work of this character is the main item, to a surprisingly low figure.

There seems to be a more or less general opinion among men of all classes that concrete structures are all more or less damp; this, however, is not the case. The source of most of this unjust criticism can be traced to structures which were very carelessly built, the unscrupulous builder finding it cheaper to substitute sand for some of the cement with the result that the concrete is porous and absorbs moisture readily, thus giving rise to the objection of "dampness." Poorly made concrete blocks (mostly sand with just enough cement to hold them together), absorb a great deal of moisture during rain storms and give rise to dampness and they probably more than any other type of concrete construction have increased this prejudice. Since one of the prime requisites of a tool house is freedom from dampness it can be readily seen that the concrete must be as dense and impervious as possible, and that adequate ventilation must be provided for, in order to meet the requirements. Failure to take into consideration the exact conditions is many times the real fault, while the blame is laid to the material and not to the poor designer. A wooden structure is in general such loose construction that ample ventilation is provided thereby, but with a concrete structure this is not true and means of direct ventilation must be provided.

Practically all railroad structures are subject to the danger of fire caused by sparks from locomotives and this is especially true of tool houses, which should be close to the main line tracks if properly located. For this reason such structures should have fireproof exteriors, for, as previously stated, the contents are in most cases worth many times the value of the building. That concrete is a fireproof material has been proven conclusively by experimental tests and by actual fires in buildings. A fireproof tool house can therefore be considered as an "insurance" on the contents, since practically all the danger from fire is from exterior sources.

The value of frame tool houses of average size is placed at from 70 to 75 cents by the valuation departments of prominent western railroads, and this is for structures of the simplest sort devoid of any display of architecture whatever. Where it is possible to so locate structures that a plain concrete floor can be used it is possible, as will be shown in detail in Part II of this article, to build fireproof structures at the same or only slightly greater cost per square foot than for wood frame structures. Any intelligent railroad official would choose a fireproof type of construction instead of wood construction if the cost of the former was the same or even a little more than that of a wood frame building, therefore it can be justly said that all that is required to start the extensive building of fireproof tool houses is the education of those concerned, along such lines.

General Requirements.

In locating a tool house care should be taken to place it away from yards and switches, where the crew will be hindered and delayed in starting or leaving work. The front of the house should be far enough from the track to permit the handcar to stand on runway between track and the house, and should in no case be less than 8 feet from the nearest rail. The floor should be level with or, better still, a trifle lower than the top of rail of the near track, so that the rails into the house will pitch slightly away from the track. The building should have an 8 foot sliding door for the admission of the handcar, windows in both ends and a ventilator in the roof.

The architecture of tool houses is nearly always of the plainest sort and concrete is therefore especially adapted to such work, for it is a material of which plain but good looking structures can be built and if the occasion demands the appearance can be further enhanced by the application of panels and reveals.

A special study of the proper size of section tool house for the various classes of railroads has been made by the American Railway Engineering Association and the recommendations made by its committee on buidlings, as given in the 1911 manual of the association, will be made the basis of detail designs shown and described in Part II. Tool houses for Class A roads should be 14 x 20 feet in plan with the long dimension parallel to the track, and the ceiling height should be 8 feet. "Class A" roads include all districts having more than one main track or those districts of a railway having a single main track with a traffic that equals or exceeds the following: Freight car mileage passing over district per year per mile 150,000, or passenger car mileage per year per mile 10,000; maximum speed of passenger trains, 50 miles per hour. "Class B" roads should have section tool houses 12 x 18 feet in plan, with long dimension parallel to the track, and an 8 foot ceiling

height. "Class B" includes single main line track with traffic less than the minimum prescribed for "Class A" and that equals or exceeds the following: Freight car mileage per year per mile 50,000, or passenger car mileage per year per mile 5,000; maximum speed of passenger trains, 40 miles per hour. For "Class C" roads, or districts, or those which do not meet the traffic requirements of "Class A" or "B," tool houses 10 x 14 feet in plan, with the short dimension parallel to the track, with an 8 foot ceiling and double swinging doors should be used.

The house should contain shelves for small tools, racks for bars and other long tools, pegs for shovels and hooks for waterproof clothing. A work bench with a blacksmith's vise and such implements as will be needed to repair the section tools should be provided near one of the windows. A box or locker with sloping top can be used as a writing desk by the section foreman.

Types of Construction.

Fireproof tool houses can be built in several different ways and it is the purpose of this article to describe these various methods of construction together with suggested detail plans and relative costs. The methods of construction to be described are (1) solid reinforced concrete walls supporting a reinforced concrete roof. (2) A skeleton of four reinforced concrete columns tied together at the top by beams supporting a roof of the same material, the curtain walls between columns to be either thin reinforced concrete, cement plaster on metal lath, brick, hollow clay tile or concrete blocks. (3) Concrete blocks supporting a reinforced concrete roof. (4) Light steel frame supporting metal lath plastered on both sides. The foundations and floors in all cases to be of plain concrete.

The particular type to select for any given case will, of course, depend upon the location, relative cost of materials and the number of houses to be built. This feature will be discussed in detail in connection with detail designs to be given in Part II of this article.

(To be continued.)

INTERNAL TEMPERATURE RANGE IN CONCRETE ARCH BRIDGES.

The scarcity of experimental data on the range of temperature in concrete arch bridges accounts for the wide diversity of practice in allowing for internal temperature variation in the design of such structures.

The results of the first series of carefully conducted tests as to temperature range in arch bridges appear in Bulletin No. 30 of the Engineering Experiment Station of the Iowa State College of Agriculture and Mechanic Arts, by C. S. Nichols and C. B. McCullough. This bulletin, besides giving the results of previous experiments, mostly on concrete dams, treats in a detailed manner field tests and experiments conducted on two large arch bridges in Ames and Des Moines, Iowa. A summary of the results and conclusions drawn will be given here.

The bridges upon which these experiments were carried out are solid barrel reinforced concrete arch spans with longitudinal spandrels of reinforced concrete, retaining earth fill upon which the pavements are laid. These bridges were designed for the usual highway traffic and consequently are of comparatively light construction.

Results of Temperature Investigations.

The tests indicate that the effective temperature range in a mass of less than five or six feet in thickness is in general about 75% of the mean atmospheric variation. The results of tests on the bridges mentioned gave an average of 2.7 and 2.6 degrees lower than 75% of the atmospheric mean variation at Des Moines during the year 1911-1912, which was 102° F.; 75% thereof being 76.5° F.

Heat Generated in Setting.

The value of 100 degrees may be taken as a safe average of the final temperature attained by concrete in setting in arch bridges of the type tested. This maximum temperature is reached in from 36 to 48 hours after the concrete is poured.

Temperature Variation.

The main point of interest in connection with the temperature rise, due to the setting action, is not so much in the amount of this maximum itself, as in the fact that apparently all the subsequent temperature change is a drop, the stress-producing variation thus becoming more nearly equal to the entire temperature range than to one-half of it.

While the above conclusion would seem to apply also to concrete arch structures typical of the ones described, the following facts demand consideration. The sheer drop in temperature during the first season might induce stresses in the steel of the arch ring exceeding the elastic limit, thus producing a permanent set in the steel. This would operate to raise the elastic limit of the material in the direction of the stress (tension) to about the point of greatest stress, and produce a permanent deformation in the arch ring. The temperature of zero stress would then be, not the initial temperature but the temperature which originally produced an elongation or distortion in the steel equal to the permanent set. During the subsequent seasonal variations, the variation of temperature would be each way from this new mean. Thus the temperature variation would be reduced to a value of more nearly equal to one-half of the temperature range than to the whole range. On the other hand, the elongation of the steel might be so localized at the point of greatest bending as to cause an unsightly crack in the concrete.

In the Walnut Street arch a temperature drop of the entire range, 87.6 degrees F., plus the entire dead load and rib shortening cause a stress in the steel of less than the elastic limit of the material. As a result, there are as yet no cracks in the structure, althought it has passed through a season of maximum external temperature variation.

In the Squaw Creek bridge at Ames, a temperature drop of 80 degrees or even 60 degrees, will stress the steel at the springline above the elastic limit, with the result that at three of the four corners of the structure there are unsightly cracks at the exact point of computed maximum stress. * * * If this cracking is due to to a permanent set in the steel, the effective stress-producing variation is now probably each way from a mean corresponding to the amount of set produced, and the stresses consequently much lower than during the first year.

In the Locust Street bridge at Des Moines, the steel is also stressed above the elastic limit with a sheer temperature drop equal to the range, and in proof of the theory advanced, there are cracks at the crown of both the shore spans at the points where a theoretical elongation in the steel corresponds to a temperature drop.

Effect of Atmospheric Temperature.

The range during the first seasonal variations, which include the high temperatures of setting, exceeded the subsequent

seasonal range by about 10% of the former. It is obvious that had the concrete been placed at any other than the extreme high temperature of summer, the heat of setting would have been dissipated to a greater extent and the range would have been less. * * * Other conditions being equal, a temperature more nearly normal would seem to be better for the concreting of arch structures typical of the ones described.

Lag.

The data on lag seem to show a more ready response to external temperature change than that obtained in the massive masonry of the Boonton dam. This would naturally be expected.

Conclusions.

From the foregoing results, the authors state the following conclusions:

I. The yearly range in temperature in a reinforced concrete arch structure, typical of the highway arch construction in this State, is, in this latitude not far from 80° F.

II. The relation between the depth of concrete covering at any point and the yearly temperature range may be obtained from the formula $Y = 90 - 0.53X$, wherein $Y =$ the yearly temperature range in degrees Fahrenheit and $X =$ the distance from the nearest exposed surface in inches.

However, the effect of the different factors, such as the presence of a water surface, direction of prevailing winds, etc., so modify the results that the authors prefer to state their conclusions as in I, giving an average value for points throughout a structure of this type.

III. The amount of direct sunlight modifies somewhat the actual temperatures in the concrete for considerable distance into the interior of the mass, although on account of the meager nature of the data gathered, no more definite conclusion can be stated.

IV. The data on the "lag" seem to show that in structures of this type the minimum temperatures are attained in time intervals anywhere from less than one day to four days after the atmospheric minimum. This interval depends upon the position of the portion of the structure considered, and is roughly proportional to the distance from the nearest exposed face.

V. Because of the high temperature in the concrete when it attains its set, and the effect of atmospheric temperature upon its maximum, other conditions being equal, the pouring of an arch ring at a temperature near the atmospheric mean annual, operates to materially lower the stresses in the ring induced by temperature variation.

VI. When uninfluenced by other factors than atmospheric variation, the rise and fall of an arch ring, typical of the ones described, agree quite closely with theory.

VII. The shrinkage of concrete typical of that placed in the Walnut Street bridge, if unrestrained by reinforcing, amounts, in 100 days after placing, to 4/1000 per cent. This induces bending stresses analogous to those produced by a temperature drop, but these are so modified by the initial stresses due to shrinkage, that the chief effect is to cause a high compression in the steel on the compression side of the bending. When, due to other forces acting on the structure, a high compressive stress in the steel is encountered, the effect of this shrinkage should be carefully studied.

VIII. To render an arch ring structurally safe, provision should be made in this latitude for stresses induced by a temperature variation of *at least 40 degrees Fahrenheit*, each way from an assumed temperature of no stress. Particular circumstances may demand that a greater variation be used for the drop in temperature to prevent the appearance of cracks. This will always remain largely a matter of judgment with the designing engineer.

New Books

MACHINE DESIGN, HOISTS, DERRICKS AND CRANES. By H. D. Hess, M. E. Cloth, 6 x 9, 368 pages, 318 illustrations in text and 18 inserts; numerous tables. Published by J. B. Lippincott Company, Philadelphia. Price, $5.00.

This book is primarily intended for students in machine design; there can be no question, however, as to its usefulness to the civil engineer engaged in construction work involving the use of cranes, hoists and derricks. It happens many times in construction work that the engineer in charge must determine the capacity of cranes and derricks employed and design and rebuild parts on short notice in order that the work be not delayed; for reference in such cases this book will be found invaluable.

The first portion of the book consists of data and formulæ to be used in designing and detailing various parts for hoists, cranes and derricks. After this illustrated and detailed examples of computations for design of winches and hoists; pillar cranes; jib cranes; underbraced jib crane; inverted post crane; wall crane; overhead electric travelling cranes; hoisting engines and locomotive cranes are given in a very clear, complete and concise manner. The necessary computations to design all parts of the above mentioned machines are given in every case in logical order and may be cited as good examples to follow in making computations for similar machines.

This work should be in the library of every engineer, since it contains an unusual amount of valuable information on the subject arranged in such a manner as will appeal to all. The general arrangement, illustrations and typography of the book are excellent and a credit to all concerned in its makeup.

REINFORCED CONCRETE WALL FOOTINGS AND COLUMN FOOTINGS. By A. N. Talbot.—Bulletin No. 67 of the Engineering Experiment Station of the University of Illinois. Paper. 6x9 in. 114 pages. Copies gratis on application to W. F. M. Goss, Director, Urbana, Ill.

This bulletin gives the results of tests to destruction of a large number of full-sized reinforced concrete wall footings and column footings. The tests give the first experimental data of the action of structural footings of this kind under conditions approximating those which exist in actual structures. The results of the tests are utilized in the discussion of formulæ and principles for the design of reinforced concrete footings.

An abstract and discussion of this bulletin will be given in a succeeding issue.

SOLUTION OF RAILROAD PROBLEMS BY THE SLIDE RULE. By E. R. Cary. Cloth. 4x6 in. 136 pages. 43 text cuts. Published by D. Van Nostrand Company, New York. Price $1.00 net.

A handy little volume illustrating by actual examples the use of the slide rule in solving problems in railroad curves and earthwork. This book was written primarily for students, but it contains information of a character which will appeal to the railroad engineer. The slide rule has been put to a multitude of different uses, but the solution of railroad problems, some of them quite involved, is indeed unique and interesting.

A short discussion of the slide rule is followed by illustrative

problems in simple curves, compound curves, the vertical curve, turnouts, the easement curve and earthwork. In the last few pages of the book is a list of constants, trigonometric formulæ and formulæ for curves, turnouts, easement curves and earthwork which are handy for ready reference. The methods illustrated should be of special value in developing short-cut methods of checking the various problems which the railroad engineer has to solve.

RAILROAD CONSTRUCTION THEORY AND PRACTICE. By Walter Loring Webb, C. E. Fifth edition. Revised and enlarged. 16 mo. Morocco. 789 pages, 34 tables, 217 figures, 10 plates. Published by John Wiley & Sons, New York. Price $5.00.

Although essentially a text-book for the use of students in technical schools, this book has always been popular as a reference book for the railroad engineer, due to the fact that it is constantly being brought up to date. The aim in the present edition, as in previous ones, is to teach principles rather than enter into extended discussions of the various structures and devices used in railroad work.

The first few chapters treat of surveys, alignment and earthwork in a very comprehensive manner. Such structures as trestles, tunnels, culverts and minor bridges are next described, the chapter on wooden trestles being somewhat more complete than the others. The chapter on ballast is based on the recommendations of the American Railway Engineering Association. Track is discussed under the headings, ties, rails, rail fastenings and switches and crossings. Miscellaneous structures, such as water tanks, stations, section and engine houses, round houses, snowfences and turntables are not treated very thoroughly even though they should be in a book of this character. General descriptions of yards and terminals and block signal systems with typical installations are next given. Chapters on rolling stock, train resistance and the cost of railroads conclude Part I. In the chapter on rolling stock a portion which could bear revision and bringing up to date is that on running gear for locomotives, no description of Mikado, Pacific or Mallet type engines being given. These types form a large percentage of the engines now being built and therefore merit treatment in this book.

Part II on Railroad Economics is very complete and in order to keep it up-to-date all the chapters have been rewritten to conform with the radical changes made by the Interstate Commerce Commission during recent years, in the analysis of operating expenses of railroads. The chapters on the effect of distance, curvature and grade on operating expenses are very complete. Part II ends with a discussion on the improvement of old lines which is very interesting. An appendix on the adjustments of instruments will be of use to the beginner. A collection of 13 tables including the usual logarithmic and tables of squares and cubes, etc., are given at the back of the book.

The fact that the author has made all recommendations as to construction work conform with the most recent recommendations of the Amer. Ry. Eng. Assoc. makes the book one of the highest possible authority and hence of greater value. The discussion on the "Extent to which a railroad is a monopoly" is interesting and in a few lines disproves the popular fallacy that a railroad without direct competition has an absolute monopoly. The American public in general does not give the railroads due credit for the good work they have done in promoting the best interests of the country.

The typography, cuts, arrangement and general makeup of the book are of the very best and a credit to all concerned. As a ready reference book this work of Mr. Webb's is without doubt the best to be obtained.

EXCAVATING MACHINERY. By Allen B. McDaniel. Cloth, 6x9 in., 340 pages. Numerous cuts and tables. Published by The McGraw-Hill Book Co., New York. Price, $3.00 net.

Excavating machinery of the most efficient type for the case in hand is necessary nowadays in order to successfully compete for work and to carry out projects which must in general be finished on schedule time. For this reason a book which describes the various types of excavators and the special uses to which they are adapted should prove of special value to the young engineer, the engineer whose clients may call upon him at any time to take charge of such work, and to the contractor. This new work is just such a book, describing all types of excavators in common use, with the exception of marine dredges. All makes of excavators are not of necessity mentioned or described, but every type is treated in sufficient detail to give a clear idea of its makeup and field of work.

The first part of the book treats of scrapers, graders and shovels, giving general and detail descriptions of the machines and cost data on various jobs in different parts of the country. The chapter on steam shovels is very interesting and gives much valuable data and information. The subject of the various kinds of dredges and their use is taken up in the second part along the same lines as the first.

The book contains many cuts and illustrations of excavators, some of which are not very clear, but as a whole they are good and aid in making the descriptions clear. A notable feature is the résumé and bibliography given at the end of each chapter; the book, therefore, besides accomplishing its purpose as previously set forth is a very good index of the literature on the subject. The typography and arrangement of the book are exceptionally good and Mr. McDaniel is to be complimented on having so ably added his share to the literature on excavating machinery.

ACTION OF THE SALTS IN ALKALI WATER AND SEA WATER ON CEMENTS. By P. H. Bates, Chemist; A. J. Phillips, Ass't Chemist, and Rudolph J. Wig, Assoc. Engr. Physicist, Bureau of Standards. Technologic Paper No. 12. Paper, 7x10 in. 157 pages. Numerous tables. Published by The Department of Commerce, Bureau of Standards, S. W. Stratton, Director, Washington, D. C. Copies gratis.

The disintegration of concrete structures due to the action of alkali and sea waters is a phenomenon which at the present time is attracting much attention and this paper should be of interest to all engaged in the concrete field. The results of chemical and physical investigation in the laboratory and field tests in sea water at Atlantic City are given both in tabular and diagramatic form, also conclusions drawn from the tests. A bibliography of literature on the subject adds to the value of the paper. Every railroad engineer should have a copy of this report in his library.

CONCRETE FLOOR HARDENER.

Hardening cement floors by the addition of a percentage of iron powder when making the mixture is not a new thing. In fact, this method of making cement floors more durable is quite general.

A new and more logical material for this purpose, however, has been put on the market by the Carbo-Lundum Hardner Co., Karpen Bldg., Chicago. This material is composed of pure carborundum grains, allundum and iron filings; these substances are refined and then finely graded from 50 to 200 mesh, remixed and packed. The carborundum and allundum provide the durable materials and the iron acts as a cementitious material.

The grading of the material insures perfect mixing, and not only does it tend to thoroughly fill the voids in the cement topping, but it really fills its own voids, making a homogeneous and compact top.

Being so dense it will not absorb oil, and dusting, so general with ordinary cement floors, is overcome because the cement cells are impregnated with a very hard and resistant material, and the cell walls will not break down.

A floor hardened with this substance is practically wearproof and non-absorbent, and it is displacing both brick and ordinary cement floors in shops, factories, warehouses and platforms. It is applied very economically, while being durable and cleanly.

The Signal Department

RAILWAY SIGNAL ASSOCIATION.

The headquarters for the annual convention of the Railway Signal Association, to be held in Nashville, Tenn., October 14, 15 and 16, will be at Hotel Hermitage, and members are requested to reserve rooms at the hotel at once so as to make sure that enough space will be set aside for those who are to attend the convention. Plans are being made for special trains from Chicago over the Chicago & Eastern Illinois and from New York over the Pennsylvania. On the 17th, after the close of the convention, there will be an excursion to Chattanooga; and if a sufficient number of members desire to make a daylight trip over the Cincinnati, New Orleans & Texas Pacific, General Manager Baker of that road will run a special train, with an observation car. Further particulars will be given in the official program for the convention, which is to be distributed to members about September 16.

SIGNAL STANDARDS, NORTHERN PACIFIC RAILWAY.

The following gives some of the many standards now used by the Northern Pacific Ry. signal department and illustrates the practice in automatic and semi-automatic signal territory on both single and double track.

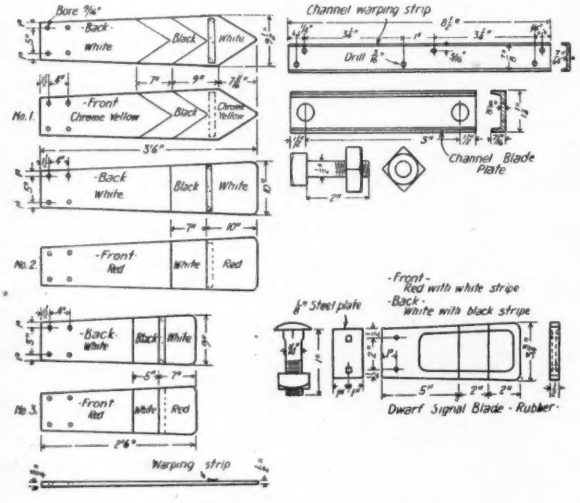
The signals now used are upper quadrant three position normally clear semaphore type. The color indications are red, yellow and green.

Semaphore Blades and Fittings.

The semaphore signal blades, shown herewith, are used as follows: Blade No. 1 is used at all automatic signals, at distant signals for interlocking plants, and at all outlying switch signals. The blade is 3' 6" long and tapers from 9½" in width at the point end to 7" at the other. The front side of the blade is painted chrome yellow with a 7" black strip, as shown. The back is painted white with a black strip similar to the front. Blade No. 2 is used at all interlocking home signals for both the high and limited speed arms, and is used also for advance, for train order, and all other stop and stay signals. The blade is square ended, 3' 6" long and tapers from 10" in width at the outer end to 7" at the other. The front is painted red with a white strip 7" in width. The back is painted white with a black strip the same width as the one on the front.

Blade No. 3 is used for all low speed and fixed arms. It is 2' 6" long and tapers from 9"at the outside end to 7" at the other. The painting of the blade is the same as No. 2. The dwarf signal blade, which is made of rubber, is 9" long and tapers from 3¾" at the outer end to 3" at the other. The painting is the same as for blades Nos. 2 and 3.

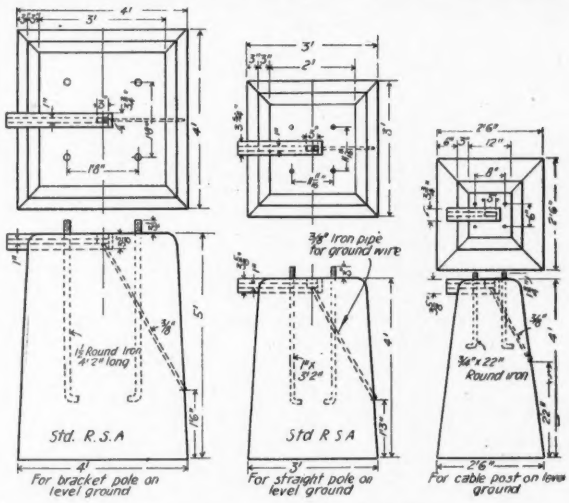
All wooden blades are made of well seasoned clear white ash, and after priming are painted two coats in the colors stated, and then finished with two coats of outside transparent varnish. Channel warping strips, as shown, are put on the back of all blades and fastened with ½" round head brass screws. Two channel blade plates are used to hold all blades in place.



Semaphore Signal Blades.

Concrete Foundations for Signals and Cable Posts.

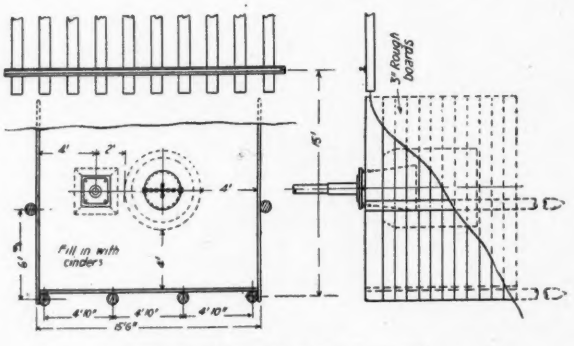
Concrete foundations for signal poles are Railway Signal Association standard. The foundation for a bracket pole on level ground is 4'x4' at the base, 3'x3' at the top and 5' deep. The anchor bolts are 1½"x4' 2" round iron. The foundation for a straight signal pole on level ground is 3'x3' at the base, 2'x2' at the top and 4' deep. The anchor bolts are 1"x3' 2" round iron. The cable post foundations on level ground are 2' 6"x2' 6" at the base, 1'x1' at the top and 4' deep. All foundations are fitted with a ground wire outlet, which consists of a ¾" iron pipe set in the concrete, as shown.


½ Round iron 4'-2" long
Std. R.S.A
For bracket pole on level ground
¾" iron pipe for ground wire
Std R S A
For straight pole on level ground
¾"x22" Round iron
For cable post on level ground

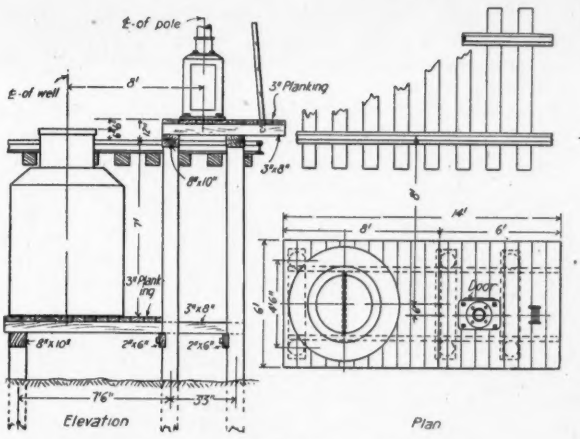
Concrete Foundations for Signals and Cable Posts.

Battery Well and Signal Supports on Fills.

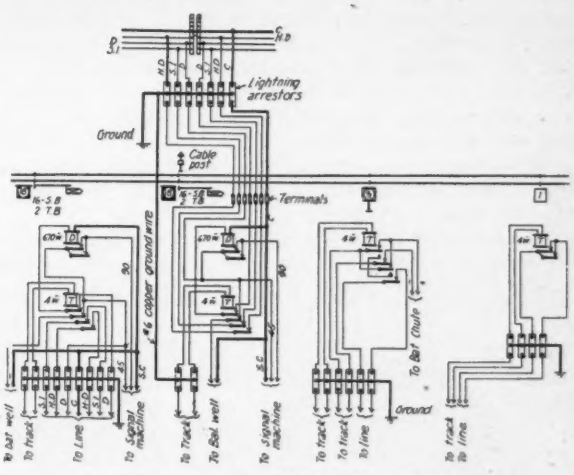
Whenever a battery well and signal are to be located on a fill, the necessary support for the apparatus is provided for by driving six piles as shown in the plan. The length of the piles depends upon the fill. After the piles are driven in place, 3" rough boards are fastened to the piles from the ground up. The space is then



Signal and Battery Well on Fill.



Signal and Battery Well on Piles.



Method of Connecting Up Lightning Arresters.

filled with cinders and the signal foundation and battery well installed.

Battery Well and Signal Supports on a Trestle.

When it becomes necessary to support a battery well and a signal on a trestle, the method shown in the illustration is used. Six piles are driven three in a row, 3' 6" apart. The center line of the nearest piles are 4' 9" from the nearest rail. To these piles are fastened the supports for the platform planking, which is of 3" material. The top of the battery well platform, which is 6'x8', is 7' below the top of the rail, and the signal platform, which is 6'x6', is 12' above the top of the rail.

The Boot Leg.

The boot leg is made by cutting two pieces of standard trunking, as shown in the plan, at "A." These pieces are fastened to the main run of trunking at each side of the rail, as at "B, B." Boot legs are placed in the second tie space from the rail joint and boot leg wires are bonded to the track on both sides of the rail. The bond wires are No. 6 copper clad B. & S. gauge and the trunking wire is No. 10 rubber covered soft drawn copper. All wire joints are soldered by pouring.

Lightning Arrester Box.

Lightning arrester boxes, as shown, are made of ⅞" white pine S 4 S and painted black. The tops are covered with sheet zinc. The box has double doors fastened on with three round head screws. Boxes are mounted on wooden cable posts as shown, 5' from the ground. Standard trunking is fastened to the track side of the post and carries the wires to and from the box. The cap on top of the trunking is let into the cable post the full face of the trunking. The brace and eye bolt for messenger wire support always points to the cross arm, where cable leads to, and the cable is tapped from the end of messenger wire to 6" inside of trunking.

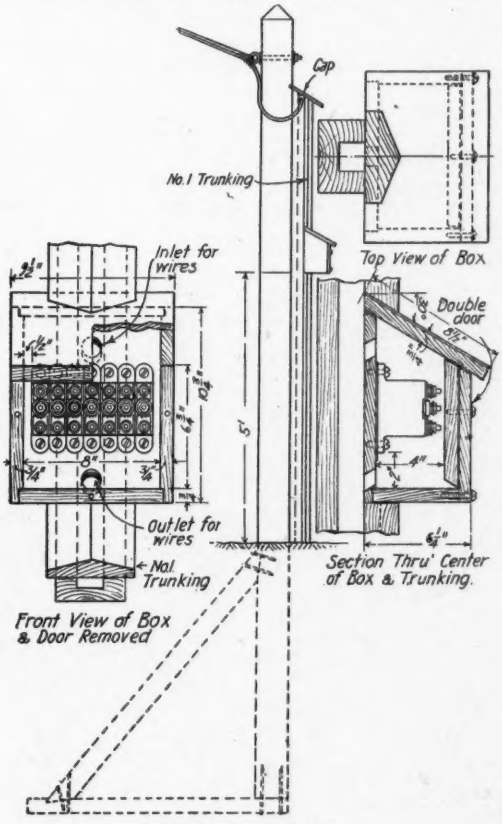
Lightning Arresters.

On single or double track, where the signal is across the track from the pole line, lightning arresters are placed in boxes on cable posts with the ground wire on the same side. The ground wire is No. 6 bare copper and connects between the lightning arresters for the line and lightning arresters for the track. This ground wire is not placed in the same trunking with other wire.

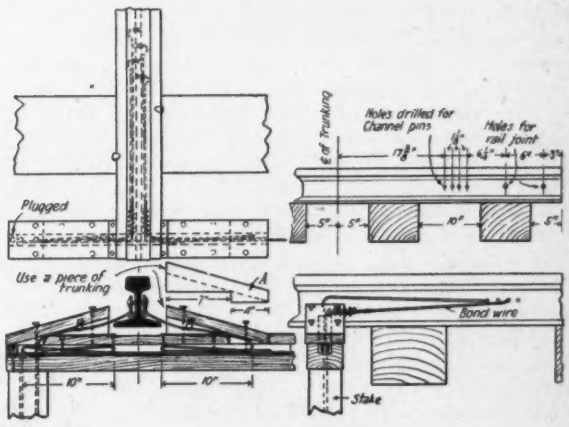
In all cases where line wire is taken through track relay points, the track relay leads are connected to lightning arresters as shown. Where two track relays are in the same box, both relays have arresters, if line controls go through the points of one of them.

Signal Circuits.

A typical double track signal circuit is given here to show the general scheme of signal operation. Note that 16 cells of soda



Lightning Arrester Box.

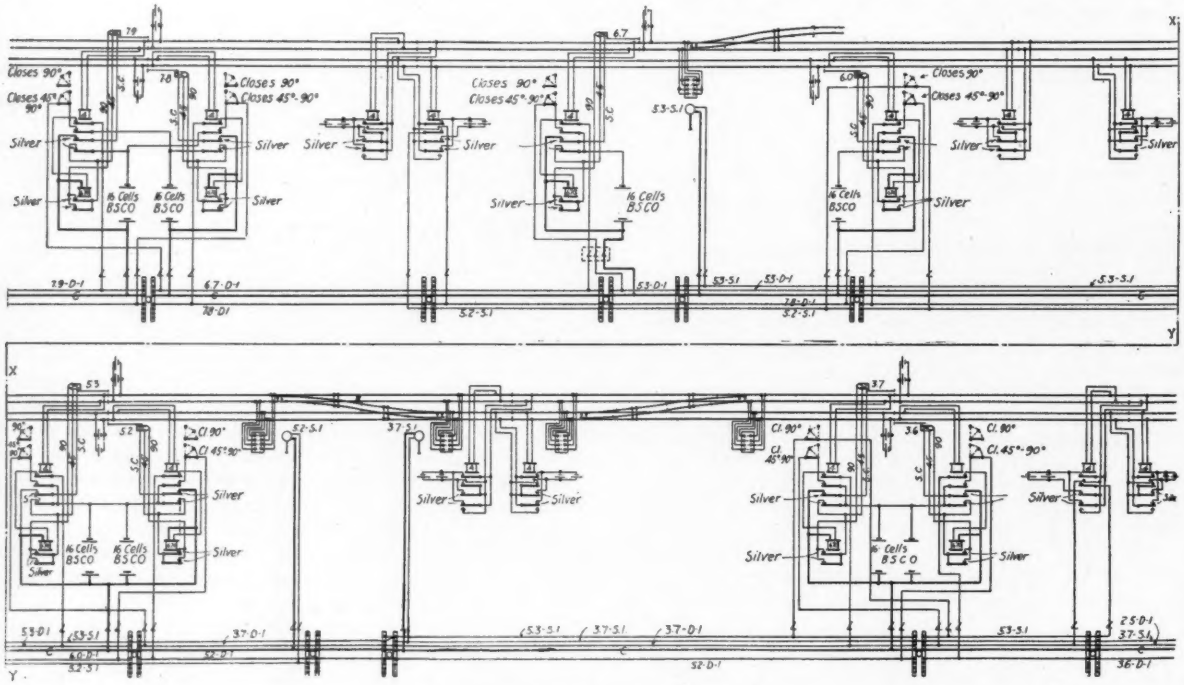


Boot Leg.

battery operate the signals, as well as the line relays and indicators connected to them. Also note that relay track cuts are used and that switch boxes shunt the track when reversed. Indicators start at the first cut section behind the second signal and receive battery from the "D" wire controlling the 45° to 90° relay at the third signal back.

Whenever a switch is reversed, the indicator at that switch, as well as indicators at all switches in the section, will show danger whether a train is approaching or not.

We are indebted to Mr. C. A. Christofferson, signal engineer of the Northern Pacific Railway, for the plans and information given herewith.



Typical Circuit for Double-Track Signals.

Personals

I. M. Page has been appointed signal supervisor of the Chicago & Alton Ry., at Bloomington, Ill., succeeding R. D. Boynton, resigned.

L. B. Porter, formerly signal inspector, has been appointed assistant signal engineer of the Chicago, Milwaukee & St. Paul Ry. at Milwaukee Shops, Wis. He began railway work in June, 1906, with the Union Pacific R. R., working on construction and maintenance until 1909. In the latter year he entered the service of the Chicago, Rock Island & Pacific Ry. as signal maintainer, and afterward became signal draftsman in the signal engineer's office. In May, 1909, he entered the service of the Chicago, Milwaukee & St. Paul Ry. as chief draftsman, signal department. In June, 1912, he was appointed signal inspector, and later chief signal inspector. He held the latter position till August 1, on which date his appointment as assistant signal engineer was effective.

A. F. Alexander has been appointed signal inspector of the Chicago, Milwaukee & St. Paul Ry. at Milwaukee Shops, Wis., succeeding J. A. Fleissner.

H. H. Cooper has been appointed assistant engineer, signal department, exterior zone, of the New York Central & Hudson River R. R., at Albany, N. Y. C. D. Cronk and W. J. Thayer have also been appointed assistant engineers, both with offices at Albany, N. Y. D. T. Green, formerly assistant signal supervisor, has been appointed signal supervisor at Albany, N. Y., succeeding C. D. Cronk, promoted. A. M. Ratigan has been appointed assistant signal supervisor at Syracuse, N. Y., succeeding Mr. Green.

F. G. Mayer has been appointed supervisor of signals, Tyrone division, of the Pennsylvania R. R., at Tyrone, Pa. The signals were formerly in charge of master carpenter J. N. Davis.

The Rayville, Pioneer & Northeastern Company has been organized at Rayville, La., for the purpose of constructing a line from Rayville to Pioneer. A preliminary survey will be made at once, then a bonus of $100,000 will be voted in the two parishes.

The Van Horn Valley has been chartered to build a railroad from Lobo, on the Southern Pacific in Leon county, Tex., about 95 miles to a point in New Mexico, crossing the Texas boundary at Crow Flat.

The Wabash has just completed and put into service a set of new double tracks between Bement, Ill., and Monticello, 10 miles. This road will soon have double track from St. Louis to Lodge, 150 miles, on the line to Chicago. The second track being built from St. Louis to the Indiana state line, 200 miles, is also near completion.

The Western Maryland will begin construction work at once on a branch from a point near Henry, W. Va., to Kempton, about three miles. This branch will be known as the Kempton branch, and will serve a new coal mine of the Davis Coal & Coke Co.

The San Diego & Arizona Ry., it is reported, has awarded the contract to Robert Sherer & Co., Los Angeles, Cal., for grading ten miles of line from a point ten miles west of Seely, Cal., to a point four miles west of Coyote Wells, in the Imperial valley.

The Anthony & Northern has completed its six-mile line from a connection with the Chicago, Rock Island & Pacific at Pratt, Kan., to a connection with the Missouri Pacific at Iuka, Kan.

The St. Andrews Bay Company, Callaway, Fla., which has purchased 100,000 acres of timber land and will erect a pulp and paper plant, is expected to build several miles of track.

The Denver & Salt Lake will begin laying rails within a few days on its extension from Steamboat Springs to Craig, and expects to have the line completed about September 20; grading is 95 per cent finished from Steamboat Springs to Hayden, and is entirely finished from Hayden to Craig.

With The Manufacturers

TRACK SUPPLY ASSOCIATION.

W. C. Kidd.

It seems fitting at this time when one examines the list of members who will exhibit at the forthcoming convention of the Roadmasters and Maintenance of Way Association of America to congratulate the members of the Track Supply Association.

This will be the third year of the existence of the Track Supply Association. Already fifty-four manufacturing concerns have signified their intention to exhibit at this convention. This is a wonderful increase over the convention held in Buffalo last year; and it was thought that the climax had been reached at that time.

A. H. WESTON, President.

WALTER ALLEN, Vice President.

W. C. KIDD, Secretary and Treasurer.

Officers of The Track Supply Association.

A great deal of credit is due the Executive Committee of the Track Supply Association for the work and interest and persistency with which they have performed their duties. They have met twice in Chicago in order to lay out a programme which would be satisfactory and meet with the approbation of every manufacturing concern.

As Secretary and Treasurer of the Track Supply Association, I want to take this opportunity of returning our thanks for the respectful treatment which has been accorded us in our endeavors to have the best exhibition of track appliances that has thus far been held under the auspices of the Track Supply Association or at any convention of the Roadmasters and Maintenance of Way Association. The cordial and respectful response which we have received from every member has been a source of pleasure to us. And when the annual meeting of the Track Supply Association is called together on the morning of September 11th, in the parlor on the second floor of the Auditorium Hotel, I predict that it will only be second in importance to the National Railway Appliances Association convention.

It would be impossible to mention here the name of every one who has assisted in this work; but to Messrs. A. H. Weston, the President; Walter H. Allen, the Vice-President; E. M. Fisher and Dickson Fairback great credit is due for the arduous duties which they have performed, which means a large amount of time taken from their regular duties.

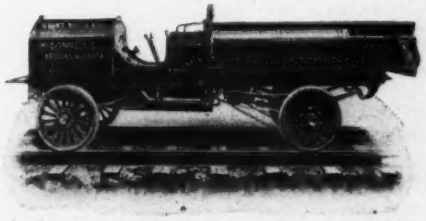
The Track Supply Association will occupy Room 938 on the Congress street side, and the members will be ready and willing at all times to render any assistance or to give any information to the members.

We earnestly trust that as many members will attend the annual meeting as is possible. I would suggest that they meet promptly so that business can be transacted in as few moments as can be done consistently with the importance thereof.

LAMBERT GEARLESS MOTOR CAR.

A decidedly novel type of motor car has been designed by the Buckeye Manufacturing Co., of Anderson, Ind. This car, illustrated herewith, is for construction use and will carry a 2-ton load without a trailer. In addition, the car can be fitted up with seats and used as an inspection car, or to take gangs of men to and from work.

The car is fitted with a draw-bar at either end, has a speed of 1 to 25 miles per hour, runs either way, and has sufficient power to provide for extra trailers when needed. Surplus fuel is carried in a large tank on side of car for long hauls. The entire mechanism is mounted on springs.



Lambert Gearless Motor Car.

The multiplicity of uses to which this car can be put should make it of interest to contractors, and railway construction and maintenance officials.

The Missouri, Kansas & Texas is planning to build from Whitney, Tex., to Hillsboro, on the main line, to make traffic arrangements with the Trinity & Brazos Valley from Hillsboro to Teague, to build about 65 miles from Teague to Trinity, connecting there with the branch to Livingston and to build from Livingston to Galveston via Beaumont. This will give the company a much more direct route to Galveston.

EXHIBITORS AT ROADMASTERS ASSOCIATION.

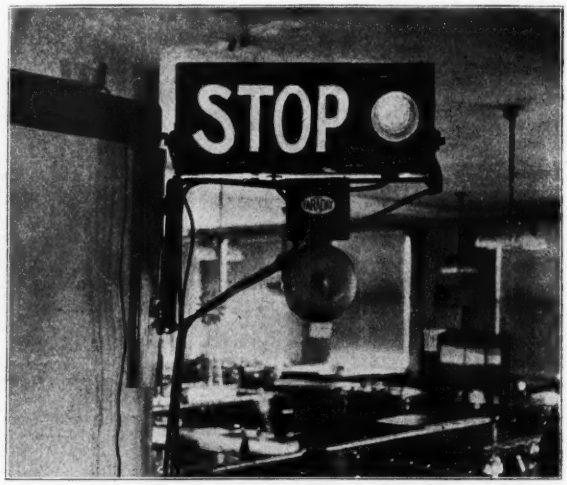
A complete list of exhibitors and members of Track Supply Association. All of these except one are exhibitors at the 31st annual convention of the Roadmasters' and Maintenance of Way Association, Auditorium Hotel, Chicago, September 9, 10, 11 and 12:

Firm.	Address.	Booth.
Ajax Forge Co.	Chicago, Ill.	10-11
American Guard Rail Fastener Co.	Philadelphia, Pa.	8
American Hoist & Derrick Co.	St. Paul, Minn.	5
American Steel & Wire Co.	Chicago, Ill.	2
American Valve & Meter Co.	Cincinnati, O.	Room 929
Associated Manufacturers Co.	Waterloo, Ia.	46-48
Barr, Jas. C.	Boston, Mass.	34
Beaver Dam Malleable Iron Co.	Beaver Dam, Wis.	54
Blessing, Louis	Jackson, Miss.	47
Carnegie Steel Co.	Pittsburgh, Pa.	1
Chicago Pneumatic Tool Co.	Chicago, Ill.	Room 928
Commercial Acetylene Ry. Light & Power Co.	Chicago.	Rooms 932 and 1000
Crerar-Adams Co.	Chicago, Ill.	50
Elliott Frog & Switch Co.	East St. Louis, Ill.	22
Fairbanks Morse & Co.	Chicago, Ill.	31-32
Fairmont Machine Co.	Fairmont, Minn.	36-38
Frictionless Rail, The	Boston, Mass., & Chicago Ill.	Rooms 932-1000
Haggard & Marcusson Co.	Chicago, Ill.	42
Hall Switch & Signal Co.	New York, N. Y.	35
Hayes Track Appliance Co.	Richmond, Ind.	49
Hobart Allfree Co.	Chicago	16
Hubbard & Co.	Pittsburgh, Pa.	15
Indianapolis Switch & Frog Co.	Springfield, O.	45
Joyce-Cridland Co.	Dayton, O.	52
Keystone Grinder Co.	Chicago	44
Lackawanna Steel Co.	Buffalo, N. Y.	20
Madden, P. H.	Sparta, Wis.	37
M. C. B. Co.	Chicago, Ill.	Room 931
M. W. Supply Co.	Philadelphia, Pa.	7
Monthly Official Railway List, The	Chicago, Ill.	40
Mudge, Burton W. & Co.	Chicago, Ill.	41-43
National Lock Washer Co.	Chicago	23
National Malleable Castings Co.	Cleveland, O.	13
Northwestern Motor Co.	Eau Claire, Wis.	51-53
P. & M. Co.	Chicago, Ill.	17
Pennsylvania Steel Co.	Steelton, Pa.	19
Pocket List	New York, N. Y.	56
Positive Rail Anchor Co.	Louisville, Ky.	39
Q. & C. Co.	New York, N. Y.	6
Rail Joint Co.	New York, N. Y.	18
Railroad Supply Co.	Chicago, Ill.	9
Railway List Co., The	Chicago, Ill.	40
Railway Engineering & Maintenance of Way	Chicago, Ill.	40
Railway & Engineering Review.	Chicago	Room 934
Ramapo Iron Works.	Hillburn, N. Y.	21
Sellers Manufacturing Co.	Chicago, Ill.	14
Simmons Boardman Publishing Co.	New York, N. Y.	57
Southern Railway Supply Co.	St. Louis, Mo.	3-4
Templeton Kenly Co.	Chicago, Ill.	12
Thompson, J. & Sons Mfg. Co.	Beloit, Wis.	29
Track Supply Association Headquarters		Room 938
Union Switch & Signal Co.	Swissvale, Pa.	55
U. S. Wind Engine & Pump Co.	Batavia, Ill.	Room 930
Verona Tool Works	Pittsburgh, Pa.	33
Whall, C. H. & Co.	Boston, Mass.	
Wharton, Wm. J & Co., Inc.	Boston, Mass.	24

UNIVERSAL SIGNAL.

A combination signal and bell has been developed, of which an illustration is shown herewith, which can be used as a crossing signal or as an adjunct to semaphore signals.

The heat from the light rapidly melts sleet and snow, and keeps the signal virtually clear in all kinds of weather. Even if the light is obscured, the bell sounds a loud danger warning.



Universal Signal.

The signal is operated by two independent light circuits. The one illuminating the bull's-eye, the other the stop sign. Parallel to the bulb illuminating the stop sign is the bell.

The circuit to the bull's-eye is connected through a plain knife or map switch to the light source, the same as any ordinary incandescent lamp would be.

The circuit for the stop sign and bell connects to the rail by means of a relay, or in case of an electric road, direct to the rail, in such a manner as to insure the throwing on of the signal as soon as the train enters the block in which the signal is located.

W. B. BROOKS, Manager
Univ. Sig. & Supply Co.

In case of a relay, the signal would be put in operation through means of a local circuit.

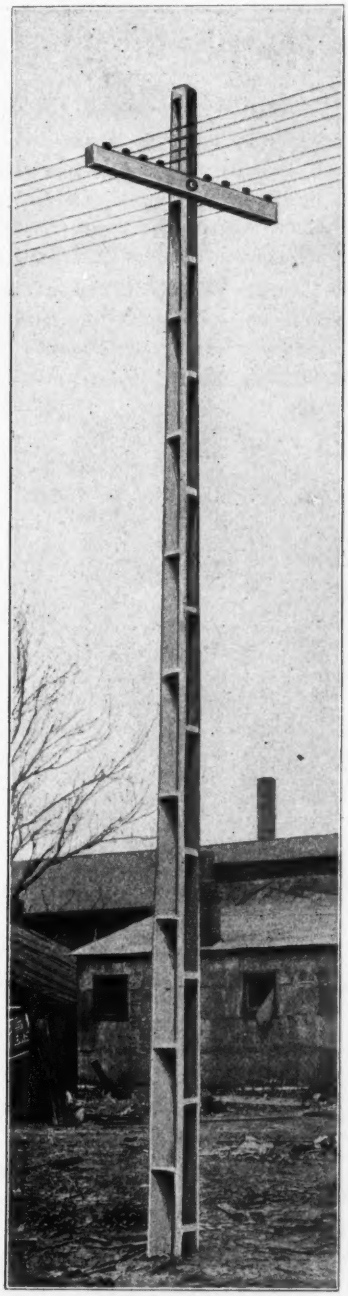
The signal described herewith is being marketed by the Universal Signal & Supply Co., Karpen Building, Chicago.

NEW HEADQUARTERS, TRACK SUPPLY ASSOCIATION.

On and after August 29 the Track Supply Association will make its headquarters at the Auditorium Hotel, Chicago.

CONCRETE POLES.

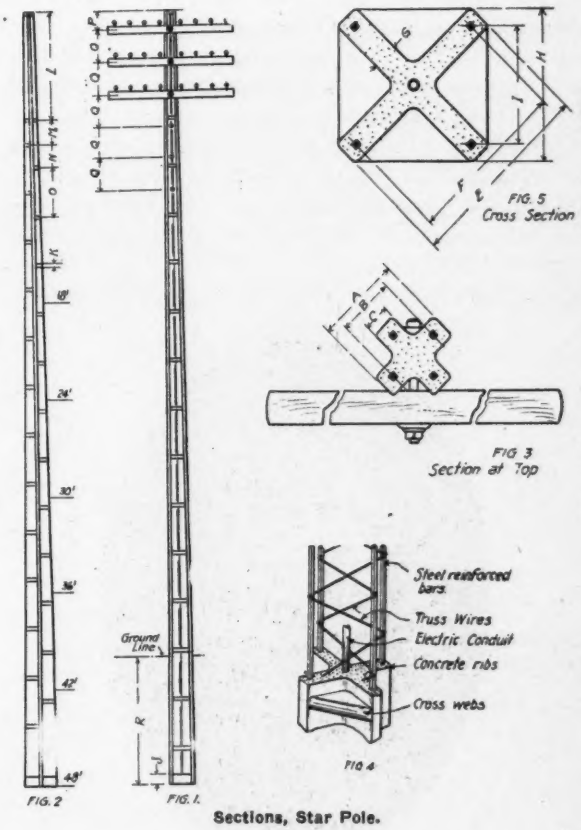
The increasing demands of the telegraph, telephone, light and power companies, and the rapid progress of electric traction, together with the increased scarcity of suitable timber poles, has compelled engineers to seek a suitable substitute possessing the desirable qualities of wooden poles and eliminating the necessity of continual maintenance and frequent renewals.



Photograph and Plan of Star Concrete Pole.

There are already in the field patented concrete poles. Some poles, which will hereinafter be designated as square poles, are merely solid concrete shafts, square in cross section and reinforced with steel rods and wire hoops. On account of their excessive weight they are not transportable, and it is necessary to erect a vertical wooden form and pour them from the top in the field. The cost of square poles is therefore quite high. Another serious disadvantage to the square pole is the fact that they cannot be climbed without the use of metal spikes which are cast in place. Such spikes will rust or break off and it is a difficult matter to replace them without considerable expense.

The steel reinforcing which is usually employed in the construction of square poles is difficult to hold in its proper position while the concrete is being poured. The actual strength of such poles is, therefore, variable and a very great factor of safety is necessarily employed. In other words, the square pole is usually made much heavier than absolutely necessary in order to allow for faulty construction, which is unavoidable in the field.



Sections, Star Pole.

The star pole, constructed according to Aschauer & Lienesch patents, is an entirely different proposition. It utilizes a minimum amount of concrete which is compressed into mechanically perfect metal moulds so constructed that the steel reinforcement is absolutely held in its proper position until the initial set has occurred. This pole depends upon the concrete merely as a protection for the fabricated steel reinforcement, which is figured to develop the entire strength of the pole.

These poles weigh only two-thirds as much as any square concrete pole of equal strength, and owing to their light weight can be produced at central plants, transported and erected the same as wooden poles. They can be readily scaled or climbed, using the cross webs as steps, are free from all exposed metal parts, and are more stable against wind pressure, owing to the "saw buck" section acting against the earth resistance. They are naturally neat in appearance and may be modified to suit the most fastidious.

It is an undisputable fact that all concrete products which can be produced in a properly equipped plant are far cheaper than those which necessarily have to be made in complicated wooden forms and erected in the field.

The result of recent tests has proven conclusively that these poles are more flexible than the square type. They are far better than wooden poles inasmuch as the elasticity of steel reinforcement, prevents them from falling to the ground when subjected to breaking loads.

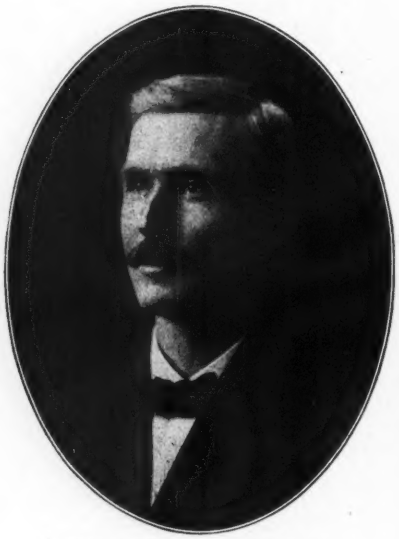
A company is being organized by Walter H. Lienesch, consulting engineer, 1032 National Life Bldg., Chicago, to place the concrete poles described herein on the market.

The Maintenance of Way Department

Roadmasters and Maintenances of Way Association

IN THE HISTORY of all organizations there are crises of more or less importance, and the way in which an organization passes through a depressing period gives an accurate idea of the predominating spirit in that organization. And the characteristics of an organization, and especially of a railway association, reflect the characteristics of the class of men represented.

Today the Roadmasters and Maintenance of Way Association



WILLIAM SHEA, President.

T. F. DONAHOE, First Vice-President.

is strong and is constantly increasing in strength and numbers. But there have been times in its history, now happily past, when the officers did not have as much encouragement as they have now. But the association was always backed by the enthusiasm and the resourcefulness of some of its faithful and time-tried members, and their untiring efforts were bound to produce results in the end.

When the work of the roadmaster or supervisor is taken into consideration, it is easily seen that as a class they seldom have much time for recreation, and for studying out and writing up committee reports. They are on duty continuously. In the winter the roadmaster has extra work on account of snowstorms, snowdrifts, blockades, frozen switches, track heaving, and many other difficulties which must be tended to regardless of personal comfort or hours of service. Laws have been made limiting the hours of trainmen, but there is no limit to the roadmaster's hours. In the spring, summer and fall it is the same. There is always a great volume of extra work to do, and frequently when the strenuous day's work is done the man is too far exhausted to do more work. The environments, then, are not conducive to the necessary further extra work necessitated by association membership, and the continuous and ever exacting demands make it difficult for the roadmaster to attend conventions. Important work is generally in progress, which absolutely requires his attention.

On the other hand, the very fact that the roadmaster is constantly and continuously combating the elements and the effects of wear and tear in such an eternally persistent manner, tends to build up, as a class, men who will never accept or admit defeat, but match increased dogged determination against new difficulties. And this very characteristic will preclude any possibility of an association of roadmasters getting into a rut and remaining for any great length of time.

The work of the roadmaster is primarily practical work. It is, or should be, nearly all outside with little office work. There is not the requirement in this vocation as in some others, for extensive studies to obtain and tabulate in reports, theoretical data. The roadmaster is a performer and not primarily an experimenter or investigator. Therefore his training has not fitted him for association work as their vocations naturally have other classes. Just so much more credit is due this class, then, when in spite of natural obstacles their Association is made a success.

It is not intended to disparage either the theoretical or practical side of the question. Both are important, but too often the designers refuse or make no attempt to get the advice of practical men before an important design is gotten out, and also make no attempt to find out how the design is making good in use. Consulting a practical man who really knows his busi-

ness would be the means of saving many dollars. Designers and performers should be brought into closer relations—into real sympathy and understanding. The practical man often takes an unreasonable stand and criticizes plans without knowing the conditions imposed on the designer.

With an accurate knowledge of the stresses involved, and also of the requirements of shop practice, there has recently been evolved a new section rail which is being extensively used in this country. It is probable that this section rail, from a theoretical and mill practice standpoint, is about as near the correct design as it is possible to make it, and if there are some changes necessary to make the rail perfect from the practical standpoint also, these changes should be suggested by practical men; but just for the reason that changes are necessary, no fair minded man will wholly condemn the original design. One of the largest fields of endeavor for the roadmasters' association is to test out different devices in actual use, and then make the results known for the common good. The field along this line is unique and exclusive and more than

L. C. RYAN, Secretary and Treasurer.

justifies the existence of the association, provided any justification were necessary.

The foregoing remarks show some of the natural difficulties which have been and are constantly being overcome. Some individuals have been especially active and enthusiastic in solving these difficulties, but an enumeration of names would probably do an injustice to some with whom the writer has not come in contact. The work of the officers for the last few years, however, merits special recognition.

In 1911, at St. Louis, the officers were: T. Thompson, president; L. C. Ryan, first vice-president; D. E. Lynch, second vice-president; and W. E. Emery, secretary and treasurer. An increased impetus was noticed at this meeting, and a large number of new members were enrolled. In spite of the excessive heat, the meetings were pretty well attended. The wisdom and farsightedness of this convention was clearly shown in the choice of officers for 1912. They were: Andrew M. Clough, president; T. F. Donahoe, first vice-president; M. H. Connolly, second vice-president; and L. C. Ryan, secretary and treasurer. (Although having nothing to do with the election of officers, it might be mentioned here that the Immortal Captain Kidd was accepted into the Association as an associate member at this convention and his assistance to the officers has been no small factor in bringing the Association to its present status.)

A mighty stride forward was made in 1912, and those who know the enthusiastic work of the president, and also of the secretary, realize to whom the credit is due. The committee subjects assigned were of a new and greater value and importance. The meeting at Buffalo, a far from central location, was a surprise to even the most sanguine in point of numbers attending and results accomplished. In fact, this convention was the opening of a newer and broader epoch in the life of the Association. The committee reports were on live subjects of vital importance—subjects in which every practical track man is interested. They included: Stone Ballast from the Crusher to the Track; Foreign Labor; How to Secure Foremen; Construction Methods and Organization.

The roadmasters' association again showed its wisdom in the selection of officers for 1913, who were: Wm. Shea, president;

W. R. THOMPSON, Second Vice President.

T. F. Donahoe, first vice-president (re-elected); W. R. Thompson, second vice-president; L. C. Ryan, secretary and treasurer (re-elected). The results of the guidance of these officers is reflected in some excellent committee reports, and again the subjects were well chosen. The wise choice of officers seems to show behind it the recommendation of men in the closest touch with Association affairs and the individual work of the members.

Several new and noteworthy innovations have been made, among them being a number of regular meetings of the board of directors during the year, to discuss pertinent matters, line up the committees, etc. During Mr. Shea's regime a committee has been organized which meets with the chairmen of the report committees in which different suggestions are exchanged, which has resulted in the reports containing information from broader sources, and in the elimination of matter which is not so pertinent to the subject and important, in the light of other investigations.

Much steady work has been done this year, probably more than ever before, and this does not belittle those earlier officers

who have given the impetus which is making the present progress possible.

The selection of Chicago as a meeting place for the thirty-first convention will make it possible for many to attend who could not spare the time to reach a less centrally located meeting place.

Plans have been made for the largest convention ever held, and present indications justify an attendance and an interest far and away above that of any previous convention of the Roadmasters and Maintenance of Way Association.

Maintaining Newly Constructed Track.

IT IS extremely difficult to find a foreman who can take hold of a new section of track and carry on maintenance in the desired manner. It seems to be a hard proposition for a man to pass up track which is bad, and move on to a place where the track is worse. New track goes out of line and surface in so many places that it is sometimes difficult to know where to begin. If it is desired to smooth up new track, the foreman should carry his level personally, and it might be well to say here, that if track is level, even if it is rough, it will ride fairly well; certainly much better than track which is somewhat smoother and not level.

Some foremen make the mistake of thinking they can tell when track is level, by the eye. The man that can tell this accurately is assuredly not in track work. His vision would be too valuable.

A section was once put up by a foreman who used his eye to level it with, and while both rails looked comparatively smooth, it was one of the worst riding pieces of track on the line. Other sections were less favored but were in better shape. This section was extremely difficult to snipe up quickly, which was desired when the foreman left. It was necessary, in order to get over the long section in the allotted time of 8 days, to leave much of this track untouched where it was uniformly out of level, i. e., one side lower than the other for some distance. Some of the worst riding pieces of track were those where the joints were not very low, but first one side was low, and a few feet farther on the other side was low. No man should be allowed to raise a single joint without putting a level board on it, and this is especially true of new track.

An essential feature in surfacing new track is to raise the track high, especially if it is down and the mud shows occasionally between ties. The second lift on new track will not be of much account if it is only two or three inches, unless the sub-grade is of unusually good quality. Of course care must always be taken not to raise the track so high that sun kinks will occur. With heavy, coarse gravel, there is not as much danger of sun kinks as with fine gravel. Good judgment must be used in putting up the track only so high that the ballast dressed in will be sufficient to hold it in surface and line.

The effect of different ideas in raising was shown plainly on a road constructed recently. There were two construction organizations on the work, one starting from each end. On one end the engineer kept after his foreman to raise the track as high as the ballast would permit with safety. On the opposite end of the track were several gangs which were pitted against each other by the roadmaster, each one striving to report the greatest number of feet raised per day. Two inches was considered a high enough lift by these men; this was just about enough so that no ballast had to be shoveled in the centers, ballast having been unloaded by Rodger ballast cars. Everyone, including the roadmaster, made a big showing. But the work didn't stay up, and the same gangs were brought back to the same sections inside of two months and another "veneer" raise made. The track raised from 8 to 10 inches stayed there, but the foremen made no enviable records of number of feet surfaced per day. At the end of the season, the roadmaster was forced to admit that the other track was better than his, and he laid it to the ballast! But as a matter of fact his ballast was a superior quality of clean, coarse gravel, and the sub-grade was probably better, as a rule, on his track.

"Records" are a mighty fine endorsement for a foreman, provided the work stays up, or provided he gets far enough away before it goes down. But low lifts and omitted tamping on a new track simply represent company money thrown away, although the individuals concerned sometimes succeed in attaining their own advancement.

ROADMASTERS' ASSOCIATION.

Programme of the Thirty-first Annual Convention, Auditorium Hotel, Chicago, Tuesday, September 9.

Morning Session.

Convention called to order at 10 a. m. by President William Shea.

Address of welcome on behalf of the city of Chicago by Mayor Carter H. Harrison.

Address by Chief of Police McWeeney

Address of welcome on behalf of the railroads centering in Chicago by Mr. W. H. Penfield, assistant to vice-president C., M. & St. P. Ry.

Reading of committee reports and general discussion.

Afternoon Session.

Reading of committee reports and general discussion.

Wednesday, September 10.

Morning Session.

10 a. m. Reading of committee reports and general discussion.

Afternoon Session.

Reading of committee reports and general discussion.

Automobile ride through the parks and boulevards of Chicago for the visiting ladies.

Evening.

Boat ride on steamer United States, leaving Clark Street Bridge at 6 p. m. Dinner will be served on board. Orchestra for dancing.

Thursday, September 11.

Morning Session.

10 a. m. Election of officers. Reading of committee reports and general discussion. Adjourn at 1:30 p. m.

Afternoon Session.

Ball game at 3:30. Cubs vs. Brooklyn.

Evening.

Theater party for the visiting ladies.

The second annual banquet given by the Track Supply Association in honor of the members and guests of the Roadmasters and Maintenance of Way Association, at the Auditorium.

The list of speakers will include:

Mr. H. R. Safford, Chief Engineer, Grand Trunk.

Mr. W. L. Park, Vice-President, Illinois Central.

Mr. W. G. Garrett, Vice-President, Great Western.
Mr. Paul Hamilton, Engineer Track and Roadway, Big Four.
Mr. James Burke, Superintendent Roadway, Erie.
Mr. C. E. Lindsay, Division Engineer, New York Central.

Friday, September 12.

Morning Session.

10 a. m. Reading of committee reports and general discussion.

Afternoon Session.

Reading of committee reports and general discussion.

Committee Subjects and Personnel.

Contracting Maintenance Work.—John Barth, C. C. C. & St. L., Chairman, Mattoon, Ill.; J. Burke, Erie, Cleveland, Ohio; T. Hickey, M. C., St. Thomas, Ont.; Guy Lowers. Erie, Buffalo, N. Y.; P. Madden, C., M. & St. P., Sparta, Wis.; N. McNabb, M. C., Niles, Mich.; F. E. Crabbs, C. & N. W., Chicago.

New and Improved Appliances.—W. H. Kofmehl, C. M. & St. P., Chairman, Elgin, Ill.; A. M. Clough, N. Y. C. Batavia, N. Y.; G. H. Brooks, St. Louis Terminals, St. Louis, Mo.; J. P. Corcoran, C. & A., Joliet, Ill.; William Hazelwood, N. Y. C., Detroit, Mich.; W. H. Cleveland, Santa Fe, Wellington, Kan.; G. M. Green, C., R. I. & P., Armourdale, Kan.

Combined Organization of Maintenance Forces.—Emmett Keough, C., B. & Q., Chairman, Aurora, Ill.; A. E. Hanson, Santa Fe, Topeka, Kan.; B. C. Dougherty, C., M. & St. P., Beloit, Wis.; J. P. McAndrews, C. & N. W., Belle Plaine, Iowa; F. B. Adams, Penn., Pottsville, Pa.; C. Linehan, C., R. I. & P., Cedar Rapids, Iowa; E. J. Boland, I. C. R. R., Freeport, Ill.

The Use of Power Driven and Labor Saving Appliances.—H. E. Astley, N. Y., N. H. & H., Chairman, Boston, Mass.; Coleman King, Long Island, Morris Park, L. I., N. Y.; J. H. Anger, N. Y. C., Newark, N. Y.; Z. B. Couch, L. & N., Birmingham. Ala.; J. W. Fletcher, Jr., Carolina & N. W., Chester, S. C.; J. W. Powers, N. Y. C., Oswego, N. Y.; Robert Fairies, Penn. Lines, Trenton, N. J.

Prevention of Accidents, Personal and Otherwise, Viewed from the Maintenance Standpoint.—J. R. Coulston, L. E. & W., Chairman, Lima, Ohio; C. J. Coon, N. Y. C., New York City; J. J. Hughes, St. Louis Terminals, St. Louis, Mo.; Henry Ferguson, G. T., Montreal, Que.; D. E. Lynch, C., B. & Q., Orleans, Neb.; G. D. Gifford, N. Y. C., Rochester, N. Y.; Frank Button, C. & N. W., Lake City, Iowa; T. H. Gaffney, M. Pac., Wynne, Ark.; George Barnoske, C., M. & St. P., Marion, Iowa; F. M. Barnoske, C., M. & St. P., Washington, Iowa.

The Chicago convention will undoubtedly be the largest in the history of the association, the officers estimating an attendance of roadmasters and supervisors approximating 600.

MAINTENANCE DEPARTMENT MOTOR POWER.

J. D. McRae.

When an Engine is Self Stoking and Self Perpetuating, and only the Fuel has to be purchased, why not get the Best? It does not seem Economy to the Motive Power department nowadays to buy a job lot of Stephenson's "Rockets" from some Scrap Pile, to head the Twentieth Century Limiteds and Overlands that speed along the present day Rails. But when the Question up for Consideration is the Securing of Maintenance Department Machinery, it seems wise to rummage the World for "Scrap Heaps" beside which Stephenson's Rocket would be modern indeed. Who, because he could hire a "Rocket" for $1.50 a Day, would consider a Mallet Compound too dear at $2.50? When the proper Efficiency Fuel is Roast Beef, Baked Beans and Good Coffee, is there Anything more Short Sighted than investing in Black Bread, Spaghetti and Water? Men who can see the Virtue of big Engines to haul Trains, ought certainly to be able to see the Desirability of Big Men to lift Rails, renew Ties and surface Track; and there is absolutely no Scarcity of the Right Kind of Men if They are offered the Right Kind of Terms. But you cannot hire a Mallet for a Rocket price.

A couple of recently observed Instances of the Current Practice will illustrate. A Foreman and five Laborers renewing Ties in easy digging Cinder Ballast were busy five full Hours handling just Eleven Ties. This was merely a fair Half Day's Work for two of the old style Trackmen. The Cost was five Dollars and twenty-five Cents, and anyone familiar with Labor conditions can easily figure a Saving of at least half the Amount by hiring Higher Grade Men at Commensurate Wages. A Group of Foreign Laborers were set to shovel up some Coal which was scattered in Small Heaps, moving it not more than 10 feet and piling it in Piles of perhaps a Ton. While under observation, no one of these Men was seen to toss a Shovelful of Coal, but slowly pushed his Shovel into It, slowly walked to the larger Pile, let it slide off and slowly walked back for another Shovelful, usually resting on his Shovel Handle for a full Minute after every second Trip. Calculation showed the Cost per Ton of handling the Coal to be Fifty-One Cents, when Ten Cents would have been extravagant. Gentlemen of the Management, when "Rockets" (you don't have to buy these machines) are costing the Stockholders more than twice the cost of Mallets for Upkeep and Fuel only, don't you think it's time to hire Mallets for the Maintenance of Way Department?

SIZE OF EXTRA GANGS.

M. Nolan, Supervisor.

After thirty years' experience as supervisor on the leading roads of the country, I certainly favor making section gangs large enough to handle all regular maintenance work, and also to lay new rail, and do reballasting. If necessary to combine three or four section gangs in laying new rail, I have the work done under my own supervision.

I am not a believer in extra gangs, when men can be obtained by the regular section foremen. In my opinion all extra gang foremen are allowed too large gangs. No man can handle more than sixteen men to an advantage, and on some roads they are allowed as many as thirty-five or forty men and an assistant foreman, and this is certainly expensive for the company. Any man at the age of thirty years, with five years' experience as section foreman, having a common school education, ought to be capable of handling sixteen men.

The St. Louis Southwestern, through a newly incorporated subsidiary called the Valley Terminal Association, has purchased about 140 acres of land at East St. Louis, Ill., on which to erect a roundhouse, shops and other terminal buildings, and a yard with a capacity of about 5,000 cars.

The Canadian Pacific is completing construction of its yards at Moose Jaw, Sask., upon which more than $100,000 will be spent.

The Atchison, Topeka & Santa Fe has awarded a contract for a "Unit-Bilt" reinforced concrete 25-stall roundhouse at Redondo Junction, near Los Angeles, to the Van Sant-Houghton Company of San Francisco.

The Western Maryland has put in service its new passenger station at Cumberland, Md. Other improvements at Cumberland include the construction of a roundhouse, machine shop, power house and enlarged freight yards. The yards will be ready for service in the near future.

The Gulf, Colorado & Santa Fe has asked bids on an eight-stall brick and concrete roundhouse at Silsbee, Tex.

The Atchison, Topeka & Santa Fe will begin work immediately on a new roundhouse at Temple, Tex., to cost about $25,000.

The Gulf, Colorado & Santa Fe has awarded a contract to H. D. McCoy, Cleburne, Tex., for a 12-stall engine house, machine shop and power house to be erected at Brownwood, Tex., at a total cost of $44,700.

The Baltimore & Ohio has given a contract to the Dravo Contracting Company, Pittsburgh, Pa., for the substructure of a double track steel bridge at Glenwood, Pa. The bridge will be 1,000 feet long and the contract for the superstructure will be let in the near future.

The Engineers Distress

TRACKMANS EDITION

Edited by A.S.Gunn.

A COMPARISON,

by- Charles Fitzsimmons.

1

Ye may jabber all yez plaze av aisy cinches,
Ye may gamble on who houlds th' saftest job--
But ye'll niver see th' color
Av a dhirty paper dollar
Ar' yez pick me fur a winner, Be gob!
WATHERBHOY!

2

Comparisons is ojus -- but convincin',
Th' Prisident is busy in his din
Accuttin' down your pay,
Jist to pass th' toime away,
An' shmokin "Thurkish Beatles" now an' thin.
SET YOUR JACKS!

3.

His salary is somethin' loike tin thousan'
He airns it aisy. Nather toil nor care,
It comes to him loike throuble
To a poor man -- only double,
An' in tin years he retires -- A Millionaire:
LIFT BHOYS!

4.

Thin, mark th' railway thrackman at his labor
In blindin glare av sun, or chill av frost:-
Whin th' Divil av bad weather
Is a tuggin' at his tether
Ye'll foind th railroad navvy at his post:
SHOVELS NOW.!

5

An' th' thravelin public jumps from town to city
On th' rushin' thrain -- a minute to th' moile,--
Its a "git there" gait -- or bust',
An' in God they put their thrust',
An' ride o'er Death an Danger wid a smile
DHROP HER!

6

But should th' thrackman linger in his juty --
A broken rail, spread gauge or misplaced switch,--
An' tis many's th' woife at home
Mourns for husband an' for son,
Whin they dhrag th' kilt an' injured from th' ditch!
MORE WATHER!

7

'Tis nothin but a tarnal round av juty --
Hard labor, care an' vigilance, an' wurruk:-
Up at foive an' home at siven;
Theres no toime to think av 'Hiven:-
Ye moight aythor be a Haythen,- or a Turruk!
STHRAIGHTEN THOT KINK BHOYS!

8

Handlin steel, or ties, or ballast, ditchin' mud cuts,
Whatever job ye're at, yur pay's th' same,
Its a dhollar an' tin cints
Wid the pay clarks complimints,--
An' ye'll curse th' longed-for day th' pay car came.
RUN UP TH' CAR.

9.

But th' thrackman's loife is very close to Nature,
His Church is bounded be th' Hivens an Airth,
His sermons is in stones,
An' th' thranquil thot he owns,
That he's ayquil to thim all - in Death!
GOODNIGHT BHOYS!

BALLADE of A BILIOUS TRACK WALKER

by Paul-M-La Bach.

My hearts oppress'd
My peace is o'er;
I know no rest,
N'o'nerer more.

The track I watch
The live long day:
All night, alone,
Abroad I stay

With weary step,
And dismal sighs,
I make a trip
To count the ties.

At another time
I walk it o'er
To settle a bet.
Forevermore.

My Weary back
Will sometime break;
A ten pound wrench
I've got to take.

To twist the nuts
And see they're tight
I go at dark,
Without a light.

In winter time
I wade thro' snows
In cold that suits
The Esquimaux.

I watch the rails
And angle bars
And see they're fit
To carry cars.

The "Supe" I watch
The live long day.
For him alone
Abroad I stay.

With lofty step
And bearing high.
He never knows
When I am nigh

TRACKMANS PHILOSOPHY.

Sure this world is full of trouble—
I ain't said it ain't.
Lord, I've had enough and double
Reason for complaint.
Rain an' storm have come to fret me!
Skies were often gray;
Thorns and brambles have beset me
On the road-but, say,
Ain't it fine today?

Whats the use of always weepin',
Makin' trouble last?
Whats the use of always 'keepin'
Thinkin' of the past?
Each must have his tribulation,
Water with his wine.
Life it ain't no celebration.
Trouble? I've had mine—
But today is fine.

It's today that I am livin',
Not a month ago.
Havin', losin', takin', givin',
As time wills it so.
Yesterday a cloud of sorrow
Fell across the way;
It may rain again tomorrow,
It may rain - but, say,
Ain't it fine today?

(- Exchange.)

The Trackwalker

ODE TO A HANDCAR.

by,- Paul-M-La Bach

Roll on, old car, roll on!
O'er each familiar rail
Roll on!
From work I must not shirk or quail
E'en though my pipes are rather queer,
And, that asthmatic ills I fear.
Oh,' hear me wheeze and sneeze! Oh hear!
But never you mind!
Roll on!

Roll on, old car, roll on!
By town and country lane
Roll on!
What's that? Must I go out again?
Another cut is getting bad?
T'is enough to make sane men mad,
But still I cry in accents sad;
Now, never you mind!
Roll on!

Roll on, old car, roll on!
O'er hill and level plain
Roll on!
Tis true I pump with might and main;
Gasping for breath, I puff and blow.
Grip the handle bar,! High-lee-high-low.
But that is my affair you know.
So never you mind!
Roll on!

"HANDCARSCRIBITIS"

by - Paul-M-La Bach

Strike the handorgans hypochrondriacal keys!
Blow the spirit stirring harp like any cyclone breeze!
Let the bass-drums martial blast
Rouse the echoes of the Past,
For of a hand-pumped hand car I wheeze

Oh: the horror of that agonizing endless hill,
Just around the curve, down below the old red mill,
Where daily; from five till six,
We have hit up our best licks—
While the big boss puts us on the grill.

What I said, in abysmal sorrow and in rage,
I shall carry down to the Catacombs of Age
Typographically lined,
On the tablets of my mind,
Just like the ode found on this same page

(Writ on a residency - 16 miles long
residence at one end - communication
by hand car.)

RAIL RAVELINGS.

Dear Dad: In your last letter you said there was danger of riding my pet hobby "Organization" to death. Well, there may be a chance of overdoing organization but it happens very seldom, doesn't it? I am not talking of "red tape." That is overdone frequently enough, and possibly it is the result of overorganization.

But to change the subject: during the period when we were repairing the washout, mentioned in my last letter, some incidents occurred which were not touched upon in that letter, and which appeared to be of sufficient importance to have received the attention necessary to have prevented them. When lining the track onto the grade, it was frequently or at least occasionally necessary to break the track and put in a pair of switch points, where the rail was too tight to be lined back to place while connected. When the track was washed off the grade, it naturally had to stretch, which left the joints open quite wide. Before the track was again put on the grade, the angle bars and rails had rusted together pretty firmly, and it was sometimes impossible to get the track back without using the switch points.

Every switch point in the material yard was used in this work, and later a pair of these switch rails were needed in a hurry to use in putting in a main line switch. Instead of taking out some of these switch points after the trains have loosened up the track, they were left in and ballast was spread with center dump cars. When this was spread out, the sand got into the expansion spaces between the rails, and when we took out the points and tried to drive up the rails in order to get the joint together, we found we had an extremely stiff proposition. To make things worse, we had received orders that morning to leave 14 men at the material yard, and send eight or ten to one of the section foremen to help out on some heavy work. This left eight men to buck back the rails, and 20 would have been none too many. We wrestled with the rail till noon and then went and took the ten men from the section foreman despite his protests, for our instructions were to get the switch in, that day. With these men we soon got our points and loaded them on a train, and then run seven miles to town, where the material yard was located, picked up the remainder of the gang, loaded a frog, switch rods, guard rail, spikes, etc., and left on a five-mile run out on the main line. On the way out, several men under an assistant foreman were set to work taking off bolts from switch rod lugs, loosening up the No. 1 rod adjustment, the connecting rod and switch stand. One foreigner assistant foreman was told, on the way out, to get his men busy with claw bars and wrenches, as soon as the train reached the spot. The other assistant foreman was instructed to cut the connection rail behind the frog, and I kept some men to bend the stock rail and put in the points. The switch ties were all in the track; in fact, a switch had been located at the spot before to run into a rip rap quarry, but was taken out because there appeared to be no further use for it. Rip rap was now required to place on the rebuilt embankments.

If the switch had been taken out right, there would have been nothing to do but bend a stock rail and put in the short piece used before to make a connection behind the frog. But the rails had been moved, so it was found necessary to cut a new connection rail.

The assistant foremen instructed each man what to do, and even went so far as to give each man his tool while on the way to the switch location. There was no delay when the gang arrived; a few men had been assigned to unloading the rails, frog, etc., and the rest started to work immediately. The reason for all of this extra preparation was the order to "put the switch in that day." The gang arrived at 4:00 p. m. and left at 5:50, with the switch stand set and switch spiked safe for traffic. This record has undoubtedly been beaten many times, but it must be admitted that there is some difficulty when the foreman does not see the switch location till 2 hours before it must be in.

The above incidents illustrate several important details: (1) ballast spread on a track where the expansion has to be driven up will cause great difficulty and expense when driving the rails; (2) driving a considerable amount of expansion, or driving it for a considerable distance, is done infinitely easier and appreciably cheaper by a large gang of men; (3) rails in track should be driven by taking off the angle bars, raising the rail, and hitting the end squarely, and not by driving against the angle bars, as little can be accomplished the latter way; (4) a foreman should always look over a switch location in advance of the gang; (5) in cases where extreme speed is required the work can be greatly expedited by organizing the men on the way to the work, and by doing everything possible before breaking the track.

You once spoke to me of the remarkably quick time in which a foreman working for you put in a temporary switch with a few men. I have forgotten the details of this method, and wish you would give them to me in your next letter.

KID.

SLIDE OUTS.

W. I. Converse, Superintendent.

Nine miles of our track runs tangent alongside a forty-foot drainage ditch, the railroad dump being made by leveling off the spoil bank left by the dredge dipper. This embankment varies from four to six feet in height. Originally, a four feet berm was left between the dump and the edge of the ditch, but the soil being gumbo overlying sand, most of this has caved into the ditch. The larger part of the embankment is gumbo and laid for two or three years before track was laid.

In several places after operation began, it was noticed that, in the summer, after the ditch had become a little dry, the dump began to slide in, and a row of piling was driven along 4 ft. from the ends of the ties, which was as far out as the driver could reach. These were twenty-five and thirty-five foot piling, with a pentration of at least 12 ft. below the ditch bottom. They were driven 5 ft. apart and in only a few places was it necessary to put a 3 in. bulkhead behind the piling, since the piling itself prevented further sliding.

Last April, on acount of a levee break, this whole territory was inundated, the current being directly across the ditch against the railroad embankment. When the drainage ditch was dug, a solid levee had been left on the opposite side to further protect the railroad in just such emergency as this. But in this instance the current was so strong that the water broke through this levee directly opposite one of these slides. A whirlpool was formed which caused a further slide, loosening two of the piles and causing them to lean three feet out of line.

Some three-quarter-inch cable was obtained and by means of block and tackle these piling were brought back into line and securely anchored to trees on the opposite side of the track, the cables being imbedded one foot under the ties. It was found that the foot of the piling still had enough penetration to render this expedient efficient. Three-inch planking was then used for bulkheads behind the piling, and the space refilled with compacted gumbo. No further trouble has been experienced, although the work was only intended to be temporary at the time.

WEAK LINKS IN MAINTENANCE OF WAY CHAIN.

Ed. L. Flinn.

Replying to your request for opinions from trackmen as to the best method in maintaining track; the one with light section force and extra gangs to help out, or to allow force enough on section to take care of the work. I am glad to respond to this request, and I can see no reason why all section foremen who read the journal could not and would not do likewise, as this is a matter of great importance to all who have to do with the maintenance of tracks. At the outset, I

want to state frankly that I am opposed to the extra gang method as well as some other features which I am going to call "weak links in the maintenance of way chain."

As I said before, I do not approve of extra gangs to do maintenance of way work, for, as a rule, they get the habit of doing slip-shod work which it takes the regular section crews considerable time to correct, if it can ever be corrected at all. So after figuring the time spent in correcting extra gang errors, I can see but little gain as compared to the amount of men employed, and little if any credit is given the section foreman, who in reality made the extra gang's work good.

For instance, suppose an extra gang is used to reballast. We will assume that the gang consists of a foreman, two assistants and fifty laborers. For the first two weeks and possibly thirty days all goes well; but after the novelty of the situation has worn off and the roadmaster begins to rush them for greater results, they will in most cases drop into the "good enough rut," with little attention paid to tamping. The foreman gets the big day's work into his head, and in such state of affairs it is no uncommon thing to find many nice rails badly surface bent, which is a damage that cannot be repaired and is worth many times a foreman's salary. On railroads in the Southwest especially you can find track ballasted with stone and slag, with only the ends tamped with shovels, and the center filled and "galvanized." I do not approve of tamping over from 12 to 16 inches on the inside of the rail with ballast of this class, but neither do I approve of little or no tamping inside the rail. This is extra gang work, and the foreman who did this work seems to be making good. You will note that the writer is not supposing such to be the case, but has come in contact with just such work, and if it were possible for me to canvass the section foremen throughout the country, I could cite you to many cases where such work has been done and the extra gang foreman got by with it and had the approval or good will of the officials.

Since I came to New Mexico and Arizona a little over eighteen months ago I have worked on track of this kind where the rail was a fine new 85-lb. A. S. C. E. rail, that in sighting where the sun reflected on it showed a slight surface kink at every tie. Do you know what caused these small surface bends in the rail? I am of the opinion that you do; or at least many trackmen will know; but for the benefit of those who don't I will say that improper tamping is the chief cause. Now here is a very common extra gang practice. In surfacing track they will lift as much as they can from the time of one train to the other and rush the tampers to keep up with the jacks; and a straw boss who is able to keep close up behind is considered a good man. No account is taken of the class of work done. The train which has perhaps been slowed down by means of a flag comes along. The foreman wants to appear on his mettle for fear the roadmaster or some other official is on, so he gives the engineer a go ahead signal. The first chance you have to see a train go over a piece of hurry up surfaced track watch the great amount of wave motion in the rails as the engine passes over, and you will then know what puts the little surface kinks in the rails. This is where the extra gang lets that engine do the tamping.

No; I don't believe in it. Men should never (on maintenance work) be pushed for quantity, but should be given to understand that quality would be the main point on which their job hinged. Bear in mind that it is not what is done in a day that counts, but it is the good results that show at the end of the year that prove the real worth of a foreman. I have twice worked my way up to the position of roadmaster and supervisor, and I have never lost sight of quality, regardless of lineal feet of track repaired or new ties inserted in a day.

I have noticed that a great many roadmasters rush their work, and as a result are continually stirring the same track either by extra force or regular section gangs. My idea is to stir track just as little as possible. For instance, when you put up a piece of track, do it with the view of never touching it until the ties are to be renewed, which should be not less than a year. My idea in surfacing track is to never raise more than can be thoroughly tamped and an easy run-off made for the next train. If the foreman in charge knows his business he can almost always do this and not have his men standing idle; and in case of an extra train, hold them until it is properly tamped. I always have my men follow the jacks doing a good job of shovel tamping, and if the gang is large enough have men follow them with tamping picks and tamp well under the rail. If a rail is surface bent I have a sufficient amount of ties tamped on the inside of the rail at that point to insure less settling, and as a result improve a bad condition. After I have raised a reasonable amount for a day's work I make a run-off and proceed to tamp what is necessary on the inside to make a good job, after which I line and fill it in.

A little investigation along these lines will show you that few extra gang foremen take these pains. A piece of good track consists of good rails and good ties, well surfaced and lined, and if any of these are left out your effort is a failure. You can, therefore, see that I am strictly in favor of large section gangs; say, two laborers to the mile of track; and then with close attention by the roadmaster, the company would soon have 65 mile per hour track.

Another feature needs attention and that is the question of laborers. In the Southwest Mexicans are used almost exclusively, and as matters stand they compare very close to nothing in doing first class track work and there is a reason for it. In fact, there is a reason for every condition, but the reason for the inferior class of laborers among the Mexicans is traceable to the way in which the foremen are allowed to handle them. For example, we will say that we have a few foremen who want to get an honest day's work out of their men, but the foreman on adjoining sections are holding men for commissary purposes. Which of the two do you think will hold his full allowance of men? A Mexican that can get a small amount to eat and occasionally get some cheap clothing (overalls, etc.) and does not have to work hard, will stay at such a camp indefinitely. And as extra gangs carry from 40 to 50 laborers and do considerably less per man than is done or should be done by section crews, naturally the extra gangs have proportionately more men than the section crews. Now matters simply stand like this: If the railroad companies would cut out the extra gangs, and allow more men on the sections, advance the section foremen's pay to a living wage, and put on a provision train instead of allowing the foremen to handle a commissary, and pay a strictly uniform price to the laborers, they would stop the tramp from gang-to-gang practice, and in a short time improve the class of laborers.

There is no scarcity of laborers, but the system of handling them either centralizes them, or they are on the tramp. To run a provision train twice a week would cost practically nothing. What I mean by that is, too many men are being held for commissary purposes, and if a man quits, lays off or is discharged, the foreman has become so commissary crazy that he simply carries these men on the time book and charges the man with that amount of commissary. So figuring the results obtained on track and the amount in dollars and cents saved, the company would be ahead in the long run. The way in which foremen (and I will include section foremen, too), get by with a stunt like the one just referred to, is very interesting to the man who has "got next," as the saying goes. Of course, he knows that his men are not up to the standard of what men should be, so in order to make a showing and have his track riding fair, regardless of the lift in surfacing, he only tamps the ends of the ties, lines the track, galvanizes the center and the work is done. He knows well enough that if he can hold out for four or five years with a high-priced commissary, he can

step down and out with ten-dollar bills enough, if properly placed, to put him on easy row. But the foreman who tries to be square with the company and put up substantial work will be considered a failure and get the worst end of the deal. So don't you see where it doesn't pay to be honest?

For the above reasons I have sent in my resignation and never again do I expect to do track work unless I know to a certainty that conditions are more on the square. If you try to get a reasonable amount of work out of your men, they simply go to the next section or to an extra gang, and the word is passed down the line that you work them too hard and in a short time you are unable to get any men and you have to step down and out. The one thing to do is to arrange matters so the man who goes from one gang to another must have a permit from the foreman whom he has just left, to go to work elsewhere. This can be easily done by having a labor employment department and keeping a photographic record of men sent out, employing men through no other channel. This would soon break up the practice of labor agents sending out worthless men and also put a check on men coming along the line with the pretense of going to work, and obtaining provisions and going away during the night. It is rulable on the road I have been working for, that when laborers are sent out to gangs, the foreman can hold $1.50 of their pay from each; 50 cents is deducted for hospital dues; this must come before the foreman is allowed to deduct anything for his commissary which he must furnish in the meantime, or the man can not work. Since March 6th I have lost over $40.00 trying to tide men over until they had enough coming so they could pay me, but who would go away leaving me the sack to hold. But the labor agent and hospital must get theirs if there is enough earned. Is it any wonder that the foremen have become dishonest? The company forces them to it and it is up to them to provide a remedy, and to reimburse the foremen by advancing their pay to a living wage.

EXTRA GANGS AND SECTION GANGS.

J. P. Costello, Supervisor.

I do not favor the idea of making section gangs large enough to do all regular maintenance work. By regular maintenance work I mean all work which can reasonably be expected or required at a more or less definite time, and I include under this head rail renewals, tie spacing, ballasting, etc., besides the more common work, such as main track tie renewals, surfacing and lining, gaging, etc.

The upkeep of a section requires not only the expenditure of a certain amount of labor, but also a certain amount of foremanship. Likewise heavy but yet regular maintenance—rail renewals, ballasting, etc.—requires a certain amount of foremanship. However, many of the things which require foremanship on a section do not require a great amount of labor. For instance, there is a broken lug bolt in a switch here, a broken angle bar on a side track there, and a couple of low joints in a slip on the main track at some other point. All these things require the attention of the foreman, and the foreman who depends on a track walker to assume the responsibility of repairs, usually—not always—comes to grief. Now, assuming that a foreman gives personal attention to a small but important matter, such as menticned above, and that it requires the assistance of from one to four men, what is to be done with the balance of the gang? Any foreman or roadmaster knows that the other part of the gang is requiring foremanship at the same time. It is my opinion that the necessity of foremanship is overlooked by the non-practical, very often.

But if I had a section (where labor was plentiful) which had been brought to a reasonable degree of physical perfection —tie renewals made and placed in good general surface and line, etc.—and if that section had two miles of ballast to renew or a similar amount of ties to space, I would then favor a large section gang to take care of the work. It is very rare, however, when we can get the right combination of conditions.

Relaying rail should be handled by extra gang for the reason that the economic handling of this work requires a larger gang than is usually possible for a section foreman to secure. Moreover, there are many things in connection with the relaying of rail, such as gaging, final tightening of bolts and surfacing which it is impracticable to handle immediately, but which will require foremanship in following up. The section foreman is the man to take care of these things, and he should be right behind the extra gang as soon as relaying starts on his section.

From an absolute "dollar and cents first-cost" standpoint, section gangs are more efficient than extra gangs. By this I mean that we can take five section gangs of five men and a foreman each and do more work and better work than an extra gang consisting of a foreman and twenty-nine men. But remember that we are concentrating our foremanship at one point. Again, those sections from which the gangs are taken are losing foremanship and labor. There are two forces acting on the ordinary section, viz., the tearing down effect of traffic and weather and the building up by the section force. The tearing down or destroying forces do not vary directly as the negligence of the section forces, but go on by leaps and bounds when the counter force is removed. Observation will prove this. I have known of sections where the regular gangs were called away to do heavy work in lieu of extra gangs and where during the same year it has been necessary to call in an extra gang to bring those sections back to a consistent state of maintenance, and it would have been better to have left the section gangs on their own sections.

The "standing up" quality of the work of an extra gang will depend to a great extent upon the degree of excellence and attention to detail required of the foreman by his superiors. If you want a "big showing" in laying rail tell the foreman not to adze the ties, not to put all the tie plates back, place only two bolts to a joint, and spike up "just enough to make her safe." If you want good work you will insist on the opposite of these things. Similarly with ballasting. Of course, good judgment must be used as to the consistency of carrying out details. I like to see clean-cut work, but in order to get it the section gang must follow up and do the gaging behind the steel gang and likewise the section gang must follow up the ballast gang to put on the perfect "top." This again shows the place for the section gang.

On the road for which I work we ordinarily have about the same trouble in keeping section laborers as extra gang laborers. At the present time it is less difficult to find and keep extra gang laborers than section laborers, due to the fact that the former receive about 10% more pay. We are depending to a great extent on native labor and laborers are brought to their work on the trains. This in a way is an advantage, as we can collect men from a greater area.

As a rule, I would say that our section foremen, whom we consider good, competent men, with a small force, would be able to handle the larger force required for relaying and ballasting. It is not easy to find a man who is willing to assume control of a large gang in preference to a section gang for the extra consideration which he receives in salary. It is usually necessary to bring some pressure to bear.

The American farmer is criticized by the European for his waste of land, and our agricultural schools are continually emphasizing the value of intensity of cultivation. Why should not the railroads intensify foremanship and supervision for economic reasons? Why not allow the section foreman to concentrate on the work which will keep up his interest?

I do not like the terms "extra gang" or "extra gang foreman," for men who are required to do a fairly definite class of work each year. The expression reminds us of "rain check." Why not make the extra gang foremen regular

foremen, and hang on to at least a part of their gang during the winter months to form a nucleus to build around during the next season?

BAD RESULTS OF COMBINING SECTION GANGS.

H. H. Smith, Tie and Timber Inspector.

It is doubtful, as long as managements have to base their expenditures on a comparison with previous months and previous years, if it will ever be possible, on most roads at least, to so fill out section gangs during the period when much work is going on, as to accomplish all maintenance work with section gangs. It is necessary to keep expenditures as nearly uniform as possible, therefore section gangs are not materially increased in the season when they most need the increase. These causes are beyond the help of the roadmaster and he, of course, must face conditions and meet them as best he can, with the force allowed him. His section gangs should, unquestionably, be large enough to do all legitimate section work, which includes putting in ties, surfacing, bolting, ditching, cutting right of way, working on switches and the numerous odd things a section gang is called upon to do. This would necessitate having larger gangs in the summer season and reducing them in the winter season, and as labor is usually more plentiful in the summer, that would seem to be the ideal practice.

There are several reasons why such work should be done by the regular gang. It can be safely assumed that, on account of probably having been on the section for some time, and desiring to stay, the section foreman is as much interested in having the track put up well as anyone else can possibly be. Ultimately he must stand the criticism for it if it does not stand up, and on the other hand, he gets the commendation if it does. He knows each weak spot, and as a general thing knows what should be done to remedy it. It is to his interest to see that each tie is properly spaced, tamped and drained, that his bolts are tight, his spikes hard down, his rail fastenings not cracked or broken, and that his ditches are of sufficient depth to fully drain his roadbed. That he does not have the force to do this properly frequently necessitates the extra gang, whose scope, as its name implies, should be limited to extra work such as building new side tracks, heavy ditching, relaying rail and initial ballasting.

There are several reasons why an extra gang should not participate in regular section work. While it is generally true that the most capable foremen are put in charge of such gangs, it is equally true that the assistant is, usually, a man of inferior ability; the wages paid the assistant will not often get a man of experience. The gang is too large for anyone to watch the work of each man, consequently you do not get the full benefit of the foreman's ability and experience. The men are recruited from numerous sources and are mostly men with little or no experience in track work, and with "globe trotting" predilections, which means new faces frequently. With these handicaps it is not to be wondered that the surfacing done by an extra gang is not up to the standard, that the tie beds are not uniformly cut and various other small things are not attended to as they should be. In addition to these handicaps, the extra gang foreman lacks the incentive to good work that the section foreman has. His stay on any one section is very limited, and to do him justice, let's add that the roadmaster needs him very badly elsewhere and has given him to understand that he must push that work and get to the next job. The result is that a good deal of ground is covered and, on paper, the work is done cheaper than it could have been done by the section gang. But is it cheaper? Experience has shown that it is not infrequently the case that section gangs have to go over such work several times and bring it back to surface. It is reasonable, therefore, to conclude that it is not cheaper in the end.

It is not the intention of this article to disparage extra gangs. They have their mission, and usually fill it. The foreman is generally chosen from the ranks of section foremen, and is selected on account of his superior ability to handle men and push his work. Sometimes a section foreman who gives promise of making a good extra gang foreman fails to fill the requirements, generally on account of his inability to handle a large gang of men. That ability is the first requisite. The laborers for an extra gang are recruited from any available source. When labor is scarce it is necessary to have a regular man to recruit men. Some foremen have a regular following who make up the bulk of their gangs. This following is usually a good reflection on a foreman's ability. If he is a good man and treats his men well he will generally have a lot of men who will follow him wherever he is sent.

Building new tracks, laying rail, initial ballasting and heavy ditching are essentially extra gang jobs. It is possible, of course, to do this work by combining section gangs; it is, however, uneconomical and unsatisfactory. To do such work by combining section gangs necessitates increasing the gangs employed to such a size as will permit the work to be done expeditiously. Very few sections have more than enough shanties to house more men than are required to keep a full gang for their regular work. There is then no means of taking care of the additional men, for it is certainly not desirable to have laborers in camp cars unless a foreman is there. If the work should be of easy access to one gang, the other gangs would either have considerable distance to go on hand cars, or would have to suffer the delays incident to waiting for train service to get to and from work. This means that the company must either lose the time it takes to get these gangs to the job and from it, or pay them overtime to get them there and keep them there long enough to get a full day's work. In either event it is an expensive proposition. The loss of time, or overtime, and the additional foremen bring up the average daily wage per man. Another objection to combining section gangs for such work, and one that is not often taken into consideration, is that the average section gang has about all it can do to do the legitimate section work, and when it is called off on extra gang work something on its own section must go undone, and this sometimes causes foremen to lose interest in their work, and also eventually requires the presence of an extra gang on the section involved. Extra gangs can keep reasonably close to their work. Living in camp cars, as they do, they can move as the work progresses, which is of course impossible with section gangs. Having camping facilities, they can take care of sufficient men to insure a full complement for each day's work.

In relaying rail, an extra gang foreman can assign certain men to certain duties each day and soon have a well-trained gang. It is not so easy to distribute section forces this way. Each gang is so accustomed to working as a unit that when they are divided out they do not give their best service. In fact section men seem to lose interest when they are separated. This clannish spirit of section gangs is more or less of a detriment in such work; it is, however, really beneficial in home section work, in that it is a stimulus to better work than their neighbors; and it is the writer's experience that they need this and any other stimulus you can invent. Another drawback to enlarging section gangs for such work is that there are quite a number of good foremen who cannot handle a large gang economically and the best results from them are obtained by working their regular force.

If the problem of taking care of the extra men needed for reballasting can be solved, it is unquestionably better to do this with section gangs, by giving each section that is being reballasted sufficient force to take care of the ballasting on that section. You will certainly get a better class of work if the foreman of the section has it to do. To accomplish this, however, the delivery of ballast and timber must be regular and uniform and in such quantities as the gang can handle. Initial ballasting should be done by extra gang. The raise given usually requires too much material for a section gang to handle economically. The section gang should follow up

this work, however, and bring up the places that have settled.

Frequent inspection of work done by an extra gang is essential. This is especially true when surfacing track. The disposition to hurry, and the realization that the section foreman is the man who will suffer for his inferior work, frequently causes a foreman to intentionally slight his work, sometimes to the extent of tamping only every second tie. Such foremen do not last long, but the damage they have done remains.

WHERE EXTRA GANGS ARE NECESSARY.

A. Swartz, Engineer Maintenance of Way.

Conditions, not only labor but physical, very often decide the manner in which regular maintenance work must be handled. As a whole, however, it is very safe to assume that the majority of railroads maintain the track and roadway by means of ordinary section gangs. If trackwork is kept up from year to year, there is very little reason for ever bringing an extra gang on a section. In the writer's opinion it is much better to enlarge the section gang to take care of emergency section work than to permit an extra gang on sections.

There are times, however, when the head of the maintenance department is required to reduce expenses to such an extent that the following year finds his division in poor shape. In such cases it is absolutely essential that extra gangs be used to put in ties, resurface, etc.

The writer, one time when taking charge of a division, found it in such condition that it was absolutely essential to employ extra gangs for regular maintenance work. As a rule the results are not up to the standard of efficiency and costs. The men think there is nothing for them when this work is done and they do not take any great interest in anything except pay day. Usually the gang is in charge of a foreman who does not know the peculiarities of that section of track and therefore overlooks essential matters. It is best to put the local foreman in charge of the extra gang, for he will get better results.

The first thing, however, to tell him is that you want "quality" not "quantity" of work. Very often records on other divisions or parts of a division are held up to a foreman as a standard. This is entirely wrong for conditions are seldom alike on various sections of a railroad.

If possible, it is much better to increase a section gang to the size of an extra gang with local labor as much more interest is shown, and usually English speaking laborers can be obtained. As a rule the section foreman can handle from twenty to thirty men on maintenance work and get more out of the gang than a so-called extra gang of thirty-five foreigners.

Combining section gangs is, as a rule, not an advantageous way of carrying on regular work, for those gangs away from home lose a great deal of time and their own sections suffer in consequence. There are times, however (usually toward the close of summer), when section gangs well up in their work can be spared to help out a neighboring section which is behind.

If a short stretch of new rail is to be laid, say one or two miles or perhaps a mile of reballasting, it is economical to have the home section at odd times do the preparatory work and then call on two or three neighboring sections to actually lay the rail or raise the track. The spacing of ties, cleaning up scrap, and trimming the shoulder can then be done by the home section. However, this is conducive to slack methods and general officers are prone to criticize if a small job is not promptly closed up.

The question of efficient work by extra gangs is one of teaching on the part of the foreman and roadmaster, for there is bound to be a great deal of loafing in a large gang. Then again the lack of interest brings about less efficient work. Large gangs in reballasting will not be as careful as necessary in properly tamping the ties, which means extra work for the section gang afterwards. They are more careless with tools and materials; but, as stated before, it is almost necessary to employ extra gangs for such work on account of various conditions.

The writer once had an extra gang reballasting that center bound about five miles of track before it was found out. The foreman then tried to excuse himself by saying that he had warned the men time and time again about the matter. Nevertheless, the track was spoiled and a slow order was necessary the next winter. I have seen very poor adzing at time of relaying rail due to inefficiency of the extra gang men. This, however, was again a question of the foreman warning the men to no avail.

It is hardly fair to say that the work of an extra gang is so inefficient as not to be economical, for with vigilance on the part of the foreman good work can be obtained. This, however, brings up another question and that is that ordinarily there is not enough competent supervision on an extra gang. In my opinion a foreman cannot economically supervise the work of more than fifteen or sixteen men. A gang of larger size should have an assistant foreman. Close supervision brings the matter back to an enlarged section gang, for greater interest is shown by local men, and the foreman can therefore demand and receive better work. The main disadvantage of enlarged section forces (unless a good sized gang is obtained) is that it takes longer and the routine work is allowed to lag. It is a well known fact that rail laying or ballasting cannot be well handled with less than thirty to forty men.

Very often great difficulty is encountered in keeping an extra gang filled up for if they are foreigners there must be more men in the gang than absolutely needed to make up for the number of men laying off each day. Then, again, the question of housing a large gang is expensive, not only in fitting out bunk cars but through lost time in moving the gangs.

We once attempted to lay rail with a gang of hoboes recruited from Chicago. To keep forty-two men at work we had to keep from ninety to 100 men in the gang and then we had practically a new gang every five or six days.

If division officers had the right to increase wages to meet the local rates paid by mills, contractors, etc., a great deal better work could be obtained and gangs could be kept full.

I had a division once on which a prominent oil company was located. They always paid 50 cents more per day than we did and they always had lots of work and lots of men to do it. The question of wages is the main point, for good American labor at 50 per cent advance over foreign labor is 100 per cent more efficient.

One very good method of obtaining extra gang foremen is to educate one man on a section to do the foreman's work. Then when extra gang foremen are needed, pick out your good foreman and let the assistant foreman run the section. Also put these assistants on an extra gang now and then with a good foreman.

Of course, where there are more extra gangs than section gangs, as will occur frequently when double tracking, it is necessary to obtain outside foremen, which is not usually satisfactory for they do not get acquainted with local conditions till a few months have gone by.

For ordinary reballasting or relaying rail, most every division has enough good foremen to equip the necessary extra gangs.

PREVENTION AND REMEDYING OF SLIDES AND WASHOUTS.

Jos. J. Morgan.

Slides and washouts are characteristic of both the Spring and Fall seasons. Their sources can generally be attributed to long periods of rain, and, in Spring, the subsequent melting of snow and the great volumes of water discharged into the rivers and channels more rapidly and in greater quantities than the streams are capable of carrying off, resulting finally in flooding the adjacent territory. Much attention is now being given to this particular subject, which presents itself so forcibly for action, in order to control the inland channels and avert, if possible, a recurrence of the disastrous flood which this country experienced very recently, the details of which are still fresh in our memories.

One of the most effective remedies against these calamities has been found in the formation of high and solid dikes at the immediate danger points, although records show that in extreme cases even these have proven ineffectual. It is quite beyond our comprehension to completely control these menaces to safety while the weather man is so generously disposed in the distribution of his surplus waters. Nevertheless, the railroad companies should work with the utmost vigilance to attain this end; to eliminate permanently all existing conditions which advance in even the slightest measure the possibility of slides and washouts; to establish the highest possible standard of safety in this respect.

The primary movement in the accomplishment of this great task is inspection, thorough inspection, complete inspection. A meeting should be called on each division of the various roads of the supervisors, roadmasters, rock and bridge foremen and all others especially familiar with this line of work. At this meeting an "elimination committee" should be appointed, composed of these officials, foremen, etc., to canvass the entire division from start to finish with a view of locating any and all conditions tending to promote the dangers in question. On their tour of the division the "elimination committee" should consult the different section foremen and obtain from them pointers as to the conditions peculiar to their particular sections. For instance, the foreman should advise of the existence of a certain stretch of track which is continually giving trouble on account of a gradual lowering or sinking, making it necessary to raise track at frequent intervals. This would lead to close investigation by the inspectors and a probable remedying of the conditions, which might otherwise be the cause of a bad washout in the event of high tide. Embankments, fills, etc., should be given marked attention; if they appear unstable, the committee should make a record of them and decide the best methods for the elimination of such difficulty. A close watch should be kept on all localities where the least doubt is entertained as to safety.

When the inspection is completed and every nook and corner carefully scrutinized, the elimination committee should again assemble at the most convenient point to go over the memoranda and data obtained, to discuss the various problems presenting themselves, and to determine the best methods of procedure towards obliterating the difficulties at hand. Although conditions necessarily alter the frequency of these inspections, as a general rule at least one inspection should be made annually; June would seem to be the most opportune month in which to carry on such inspection, for ample time would then be given to make any repairs which might be found necessary prior to the arrival of the "wet" season. All uncertain points on the various divisions should be looked over by the committee during January or February as conditions permit, to detect and offset the occurrence of slides and washouts before the Spring freshets occur.

In conjunction with this matter of inspection, a first-class "follow-up" system should be devised, which would affect the complete carrying out of all repairs recommended by the elimination committee, in order that the inspection bear fruit. For, after all, what would be the object of an inspection if the recommendations failed to materialize; therefore, the need of such a system is clearly evident. Each meeting of the committee should include a review of previous data, to ascertain whether the repairs recommended were brought to a completion.

In some sections of the country the tracks occasionally border on clay banks and the like, which help support the roadbed. At such points, if indications of weakness are apparent during the very rainy periods, several cars of cinders should be held in readiness at the nearest possible point for emergency use, as it is often a difficult matter, through lack of equipment and other causes, to procure this material on short notice. Timely foresight would here result in opportune preparedness. The small rough stone cleaned from rock cuts can be utilized to good advantage in the reinforcing of roadbed and shoulder and as riprap along river banks.

Proper drainage has proven to be an all-important factor for the existence of good track; in fact, it is an absolute essential to good track. During these longs spells of rainy weather there must be adequate drainage in order to carry off the great volumes of water common to these seasons. All supervisors, roadmasters and foremen should give unlimited attention to the item of drainage, as it is one of their strongest lines of defense with which to combat the inundations incident to the rainy seasons—by maintaining the highest possible standard of their respective territories.

Should a washout appear imminent, preliminary precautions should be immediately taken to prevent a dislocation of the tracks. There is probably no more adequate means of attaining this end in an emergency than the use of bags of sand for holding track in position. Therefore, a large supply of this material should be kept within the "danger zones" on the different divisions affected by floods. If a washout is inevitable, a mobilization of all forces possibly obtainable should be arranged for quickly, necessary provisions, cars, etc., provided, as well as a good supply of filling and other material on hand at the nearest point of vantage in order to have sufficient men and material ready in the nick of time to replace and reinforce track with the least possible delay to traffic. The passage of trains over submerged track is indeed decidedly unsafe. Although such action might prevent much delay, it might also result in roadbed giving way. But why take a chance in such a case as this? Better wait until the water has subsided and a careful inspection made, thus living up to the motto of the hour—"Safety First and Always."

GOOD RESULTS FROM EXTRA GANGS.

T. Hickey, Roadmaster.

The world of transportation is vitally interested in reducing to a truly economic minimum the cost of maintaining railway properties. Chief amongst these properties is the permanent way; a factor of its up-keep is labor. It is possible only by strict, accurate and continuous accounting to know the cost of maintenance of any railway system. Insofar as the labor costs are concerned, this accounting must depend on data furnished by the foreman in direct charge of the laborers who perform maintenance work.

Two methods of handling maintenance have come into common use. One we may designate as maintenance wholly by regular section crews, and the other as maintenance by section crews assisted in doing certain work by extra gangs.

The economy of one as compared with the other depends largely on conditions of which there are many. Railroads with high speed and heavy traffic must be carefully considered, there are advantages and disadvantages.

The method of handling maintenance wholly by the regular section crew is possible with economy only on railroads with high speed and heavy traffic, as such railroads naturally pass through a thickly populated country, making labor more plentiful, and by which the required number of men can be obtained to meet the requirements of the increased force, large enough to handle all regular maintenance work; work will be better done by this method, as the foremen will always take an interest in seeing and in knowing that the work is properly done on the section of which he has regular charge, while the extra gang foreman figures on making a big showing and in seeing how much ground he can cover to show in his daily report; the regular section foreman who has to follow the extra gang, putting the track in condition, is the one who best knows this.

Except in cases of emergency I am opposed to combining section crews for renewal work, as by so doing I find that the men lose a certain amount of interest in the work on their own sections. I find that the best results can be obtained where the men are left steadily on their own section, and then the work done by each gang can be compared with that of his neighboring gang; the amount and kind of work performed each week will show on one section as compared with the other. When those details are closely and accurately watched, good results are forthcoming as

will be seen by the condition of the track approaching the winter season.

The method of maintenance by regular section forces aided occasionally by extra gangs in relaying rail, ballasting, etc., is generally practiced by most railroads.

Many railroads passing through a country that is lightly populated find it difficult to obtain force large enough to handle all regular maintenance work, while sufficient force can be and is obtained for section forces to be aided occasionally by extra gangs which are moved in camp cars from one point to another as the work conditions demand. Extra gangs, as a whole, are not as efficient as section gangs, but with proper and careful management, good results from extra gangs are obtained. It is good practice to have the section gang follow up the extra gang, more particularly when ballasting, and touch up the spots for surface and line, as it is not to be expected that the details can be closely watched by a large gang.

The advantage gained in this method of maintenance work is one of considerable importance, and more particularly where labor is scarce. It would be difficult, if not impossible, to obtain sufficient force to take care of the work of maintenance. This I find would be the greatest trouble on the division I have charge of; while with camp cars properly prepared there is no particular difficulty in keeping sufficient extra gang laborers.

I select my extra gang foremen from section foremen. Each extra gang foreman has an assistant, who is also selected from section forces. If the assistant proves to be a good man after he has some experience as assisting foreman, he is promoted to foreman of extra gang. The experience he gets while an assistant foreman should be of great value to him after he is promoted to foreman.

While my section foremen, as a rule, are capable of handling large gangs in ballasting and relaying, I have some section foremen who can handle six or seven men as well as any foreman could be expected and obtain the best results, yet those foremen would not do to place in charge of large gangs. On the other hand, I have section foremen who are capable of handling large gangs, but will not, as they do not want to be away from their homes and families.

Our extra gang foremen are paid $12.50 more than is paid a section foreman, and I find that this is scarcely enough to induce many good section foremen to take charge of extra gang. I am convinced that an extra gang foreman's pay should be at least $20 per month more than that paid a section foreman.

I am in favor of doing maintenance work by section gangs to be assisted by extra gangs when ballasting, relaying, etc., and consider it good practice.

APPORTIONING WORK TO SECTION AND EXTRA GANGS.

S. Cheatham, Roadmaster.

I favor making section gangs large enough to handle all regular maintenance work where men can be had, but on a division where men are scarce, it is always necessary to give some assistance with an extra gang.

I do not favor combining section crews for renewal work and laying rails, etc. I am in favor of all this work being done by extra gangs. I find that extra gangs are not as efficient as section gangs as a whole, and that work done by extra gangs does not stand up as well as work done by section men. I find, too, that it is not as economical to do work with extra gangs as with section forces for the reason the labor that we have in extra gangs is inferior labor, and we pay the extra gang foreman a larger salary than we do the section foreman. We always have an assistant foreman who demands a larger salary than the section foreman. Section gangs are made up of the natives and they are more or less familiar with the work that is to be done on the track, and as a rule more industrious, and will naturally turn out more work.

With reference to extra gang laborers, I get all my laborers from the south, most all of them from Mississippi, and I work colored labor altogether, especially on my extra gangs, and experience a good deal of difficulty in obtaining laborers and practically keep a man on the road continually through the summer season getting laborers; I have to get a new gang every month.

I don't favor using section gangs in reballasting. I prefer to have this work done by extra gangs and have the section gangs work behind the extra gang smoothing, surfacing, and filling in and dressing up the track, and taking care of other maintenance work as it shows up.

Extra gang foremen are obtained from the section foremen. Section foremen as a rule are not capable of handling large gangs in reballasting or relaying rail.

SYSTEM WANTED.

At a certain coal mine down in New Mexico the superintendent was greatly annoyed, from time to time, by employees moving into and out of the company's houses without due notification of their frequent changes of domicile. It became quite impossible to keep the rent accounts straight in the office books, and finally the superintendent, in his exasperation, resolved upon stringent measures. He therefore posted the following notice, which is given verbatim—orthography, syntax and all:

february the 11th.

Notice to all employees

aney Person or Persons that Mooves into A house Without My Consent shall be Put out Without anney Cemmony.

Dam it I Must and Will have some Sistom.

[Signed.] Hen Filster.

Personals

W. A. Andrews, roadmaster of the Atlantic Coast Line R. R., has been transferred from Tarboro to Fayetteville, S. C., succeeding S. M. Beasley. W. C. Bruner has been appointed roadmaster at Charleston, S. C. J. E. Hines has been appointed acting roadmaster at Tarboro, N. C., succeeding Mr. Andrews. H. H. Renfro, roadmaster, has been transferred from Leesburg to Sanford, Fla. J. M. Tuten has been appointed acting roadmaster at Leesburg, Fla., succeeding Mr. Renfroe.

C. Ogden has been appointed assistant roadmaster of the Canadian Northern Ontario Ry. at Sudbury, Ont.

B. C. Haskins, roadmaster of the Canadian Northern Quebec Ry., has been transferred from Quebec to Limoilou Junction, Que.

A. B. Campbell has been appointed roadmaster of the Chicago, Burlington & Quincy R. R., at Greybull, Wyo.

George H. Carpenter has been appointed roadmaster of the Chicago, Rock Island & Pacific Ry., at El Dorado, Ark., succeeding R. T. Callahan. W. E. Hoberlaw has been appointed roadmaster at Sioux City, Ia.

Jose Gonzalez, roadmaster of the Cuba R. R., has been transferred from Marti to Alto Cedro, Cuba.

D. Harley, roadmaster of the Delaware, Lackawanna & Western R. R., has been transferred from Binghamton to Syracuse, N. Y.

J. H. Conlan has been appointed general roadmaster of the Denver & Rio Grande R. R., Colorado Lines, office at Denver, Colo., succeeding P. C. Connelly, resigned. D. Rushford has been appointed roadmaster at Salt Lake City, Utah, succeeding J. H. Bowen.

H. J. Gordon has been appointed roadmaster of the Galveston, Harrisburg & San Antonio Ry., at Victoria, Tex., succeeding B. F. Davis. George Reiss has been appointed roadmaster at Rosenberg, Tex., succeeding V. C. Nall. W. F. Wise has been appointed roadmaster at Victoria, Tex., succeeding W. S. Higgins.

J. V. Murphy has been appointed roadmaster of the Houston & Texas Central R. R., at Ennis, Tex.

F. A. Larson, formerly assistant roadmaster, has been appointed roadmaster of the Great Northern Ry., at Whitefish, Mont., succeeding J. J. Hess, promoted. C. Holm, assistant roadmaster, has been transferred from Aneta, S. D., to Everett, Wash., succeeding H. Wolk. J. Kayamore has been appointed assistant roadmaster at Essex, Mont., succeeding W. F. Hart. Ed Kelly has been appointed assistant roadmaster at Leavenworth, Wash., succeeding J. Martin. L. McElroy has been appointed assistant roadmaster at Great Falls, Mont., succeeding A. Larson.

A. G. Wilkes, roadmaster of the International Rys. of Central America, has been transferred from Patalul to Escuintla, Guat.

J. J. Daley has been appointed roadmaster of the Lake Shore & Michigan Southern Ry., at Alliance, O., succeeding M. E. Cowen.

T. P. Hines has been appointed supervisor of the Louisville & Nashville R. R., at Nashville, Tenn., succeeding E. A. Jackson.

W. O. Houston, division engineer of the Michigan Central R. R., has been transferred from St. Thomas, Ont., to Jackson, Mich. S. D. Williams, Jr., recently appointed acting division engineer at Niles, Mich., has been appointed division engineer at St. Thomas, Ont., succeeding Mr. Houston.

WM. E. HOBERLAW, Roadmaster
Chicago, Rock Island & Pacific Ry.

C. E. Cannon has been appointed roadmaster of the Missouri, Kansas & Texas Ry., at Oklahoma City, Okla., succeeding W. O. Lambert. R. W. Gooch has been appointed roadmaster at North McAlester, Okla., succeeding G. Putnam. S. G. Quinlisk has been appointed roadmaster at Parsons, Kan., succeeding A. Graham.

J. H. Pruitt has been appointed roadmaster of the Missouri, Kansas & Texas Ry., of Texas, at Granger, Tex., succeeding L. McElroy. C. J. Rogan has been appointed roadmaster at Smithville, Tex., succeeding J. R. Woods.

A. G. Chanes, roadmaster of the National Rys. of Mexico, has been transferred from Durango, Dgo., to Cardenas, S. L. P. J. Elizondo, roadmaster, has been transferred from Cardenas, S. L. P., to Acambaro, Gto. T. Garcia, roadmaster, has been transferred from Acambaro to Durango, Gto.

P. S. Green has been appointed acting supervisor of track of the New York Central & Hudson River R. R., at Syracuse, N. Y., succeeding H. H. Lincoln.

C. A. Haggerty, track supervisor on the New York, New Haven & Hartford R. R., has been transferred from Harlem River, N. Y., to Stamford, Conn.

P. L. Demmer has been appointed assistant roadmaster of the Northern Pacific Ry. at Tacoma, Wash.

J. C. Bell, formerly assistant division engineer, has been appointed roadmaster of the Oregon Short Line R. R., at Shoshone, Ida., succeeding J. Collins, assigned to construction work. Mr. Bell was formerly connected with the Southern Pacific Co. as assistant engineer. P. O'Connor has been appointed roadmaster at Nampa, Ida., succeeding P. A. Pheney, who has been appointed general track foreman at Pocatello, Ida.

E. C. Buhrer, roadmaster of the Oregon-Washington R. R. & Navigation Co., has been transferred from Pendleton to La Grande, Ore. T. Keaveny, formerly assistant engineer, has been appointed roadmaster at Colfax, Wash., succeeding J. L. Twyman, transferred.

W. F. Miller has been appointed supervisor of the Pennsylvania R. R., at Lewisburg, Pa., succeeding F. C. Stoughton. T. E. Nestor has been appointed supervisor at Clayton, Del. H. D. Stowe has been appointed supervisor at Dunkirk, N. Y., succeeding W. V. Betts. W. R. Trowbridge has been appointed supervisor at Mount Holly, N. J., succeeding J. C. Gucker, resigned to engage in private business. N. P. Vernon, assistant supervisor, has been transferred from Lamokin, Pa., to Jersey City, N. J.

J. C. BELL, Roadmaster
Oregon Short Line R. R.

T. E. Gossett has been appointed roadmaster of the San Antonio & Aransas Pass Ry., at Cameron, Tex., succeeding J. O. Drake.

O. M. Barlow, roadmaster of the Southern Pacific Co., has been transferred from Mina to Hazen, Nev. S. M. Robinson has been appointed roadmaster at Mina, Nev., succeeding Mr. Barlow.

George Iverson, roadmaster of the Union Pacific R. R., has been transferred from Omaha to Sidney, Neb., succeeding T. J. Sinnott. C. M. Johnson has been appointed roadmaster at Kearney, Neb. W. M. Kilgore has been appointed roadmaster at Grand Island, Neb., succeeding E. Brown. T. J. Sinnott, roadmaster, has been transferred from Sidney to Omaha, Neb., succeeding George Iverson.

The New York Public Service Commission for the First district has executed a contract with the E. E. Smith Contracting Co. for the construction of that section of the Broadway-Manhattan subway lying between Union Square and Twenty-sixth street, the bid being $2,056,702.50.

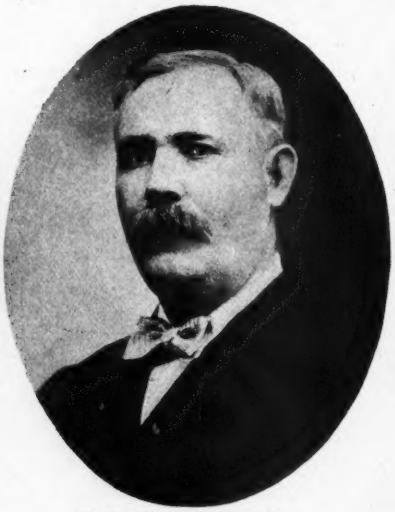
A report says that a plan for construction of a railroad from St. Marys, Ohio, to Ft. Wayne, Ind., has been laid before the Commercial Club of Ft. Wayne by S. K. Blair, superintendent of the New York, Chicago & St. Louis R. R.

The Susquehanna & New York has for sale a number of tank cars.

Members of the Roadmasters' and Maintenance of Way Association

(Names Arranged Alphabetically)

F. B. ADAMS, Supervisor of Track
Philadelphia & Reading Ry.

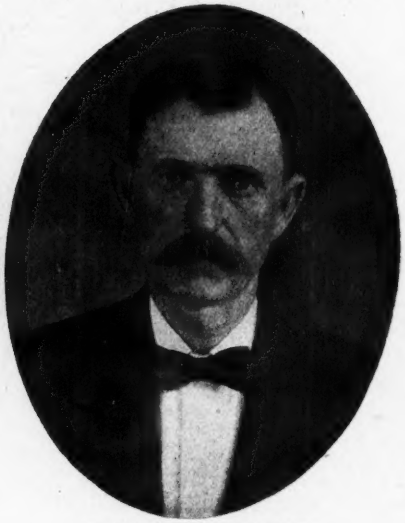


M. J. ADAMS, Supervisor
Baltimore & Ohio R. R.

J. H. ADOLFS, Roadmaster
Quincy, Omaha & Kansas City R. R.

G. H. ALLEN, Supervisor of Track
Grand Trunk Ry.

H. E. ASTLEY, Supervisor of Track
New York, New Haven & Hartford R. R.

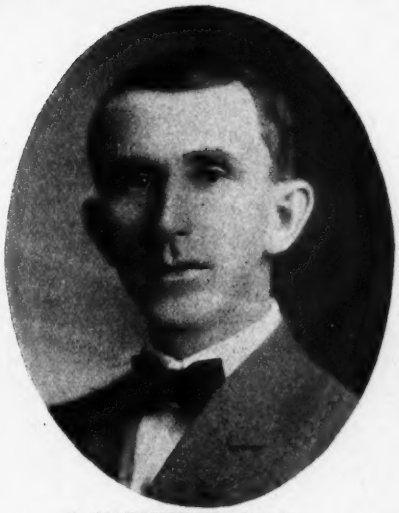


J. N. BAKER, Roadmaster
Tremont & Gulf Ry.

F. M. BARNOSKE, Roadmaster
Chicago, Milwaukee & St. Paul Ry.

JOHN BARTH, Supervisor of Track
Big Four Ry.

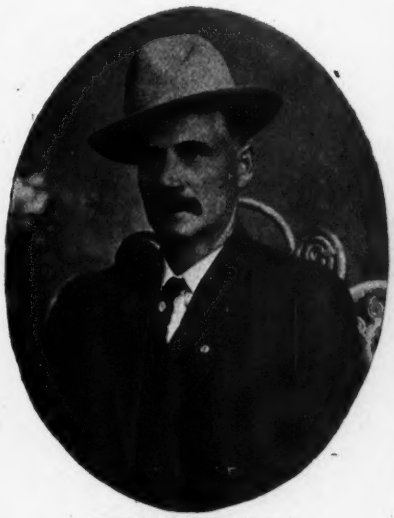
A. J. BASS, Roadmaster
Seaboard Air Line R. R.



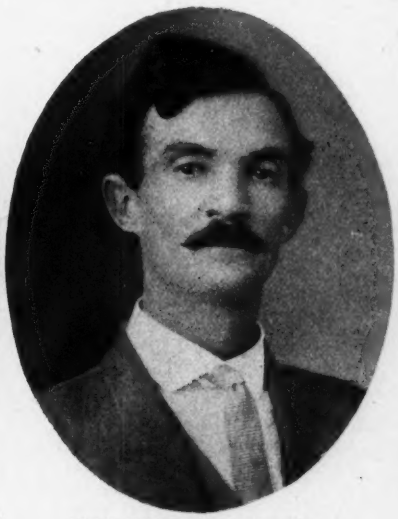
R. H. BAYER, Roadmaster
Houston & Texas Central R. R.

J. M. BELLAMY, General Roadmaster
Chicago, Indianapolis & Louisville Ry.

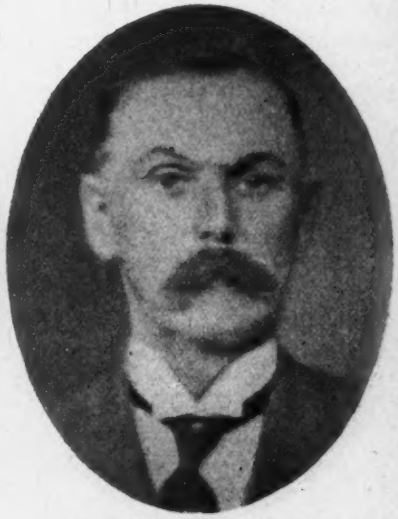
ED. BLAGRAVE, Roadmaster
Missouri Pacific Ry.



J. D. BOLAND, Roadmaster
Chicago, Milwaukee & St. Paul Ry.



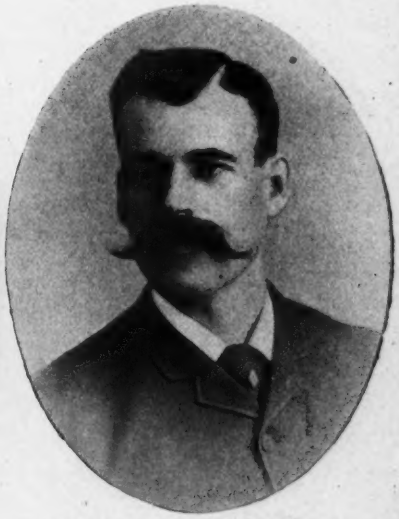
JOHN BOLTON, Roadmaster
Chicago, Rock Island & Pacific Ry.



W. A. BRANDT, Roadmaster
Chicago & North-Western Ry.

B. H. BRIGGS, Roadmaster
Chicago, Rock Island & Pacific Ry.

G. S. BROOKS, Roadmaster
Terminal R. R. Association of St. Louis



B. F. BROWN, Track Supervisor
Boston & Maine R. R.

J. D. BRUNK, Roadmaster
Kansas City, Mexico & Orient Ry.

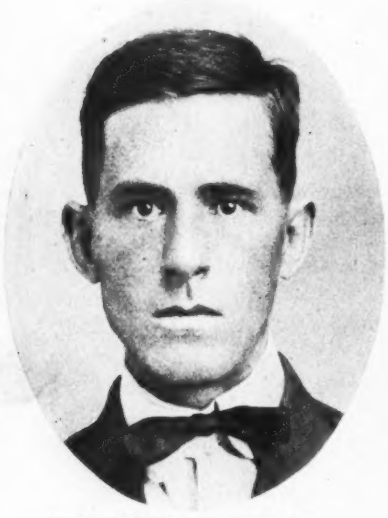
A. BURGETT, Supervisor
Erie R. R.

M. BURKE, Roadmaster
Chicago, Milwaukee & St. Paul Ry.

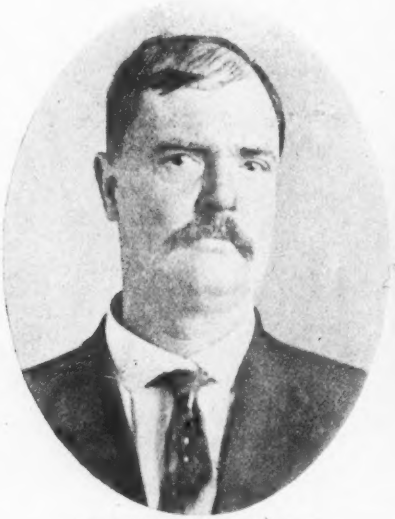
EDWARD BURR, Supervisor of Track
Big Four Ry.

E. BEN CARTER, Engr. Main. of Way
Florida East Coast Ry.

THOS. CHALLONER, Roadmaster
Northern Pacific Ry.



W. S. CHEATHAM, Supervisor
Middle Tennessee R. R.

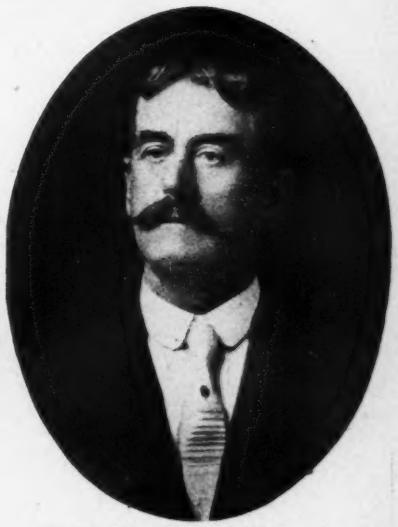


J. T. CHERRY, Roadmaster
Missouri Pacific Ry.

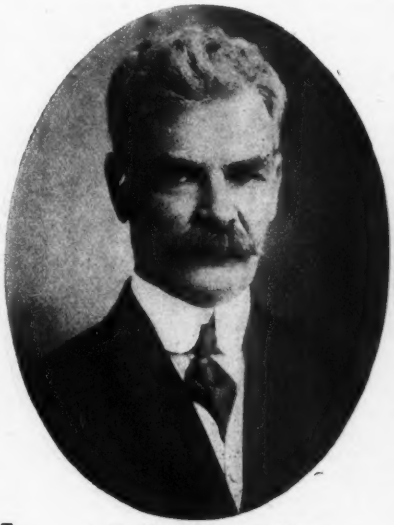
C. B. CLARKE, Roadmaster
Norfolk & Western Ry.

J. A. CLAYMAN, Roadmaster
Lake Shore & Michigan Southern Ry.

J. CLENDENNING, Roadmaster
Southern Pacific Co.



W. H. CLEVELAND, Roadmaster
Atchison, Topeka & Santa Fe Ry.



A. M. CLOUGH, Supervisor
New York Central & Hudson River R. R.

N. R. CLUSTER, Supervisor
Elgin, Joliet & Eastern Ry.

W. C. COLE, Roadmaster
Pere Marquette R. R.

M. H. CONNOLLY, Supervisor
Cincinnati Northern R. R.

JOHN CONNOR, Roadmaster
Illinois Traction System

M. J. COONEY, Supervisor
Erie R. R.

J. P. CORCORAN, Supervisor
Chicago & Alton Ry.

F. E. CRABBS, Roadmaster
Chicago & North-Western Ry.

J. W. CRAIG, Roadmaster
Nashville, Chattanooga & St. Louis Ry.

F. L. CULVER, Supervisor of Track
Bangor & Aroostook R. R.

DAN CUNNINGHAM, Roadmaster
Michigan Central R. R.

J. W. DAHL, Supervisor
New York Central & Hudson River R. R.

J. DAUGHERTY, Roadmaster
St. Louis & San Francisco R. R.

F. G. DAVEY, Roadmaster
Toledo, St. Louis & Western R. R.

W. E. DAVIN, Supervisor
Pittsburgh & Lake Erie R. R.

C. H. DAVIS, Consulting Engineer
New York

G. A. DeMORE, Supervisor
New York, New Haven & Hartford R. R.

GEO. A. DENSMORE, Roadmaster
Bangor & Arcostook R. R.

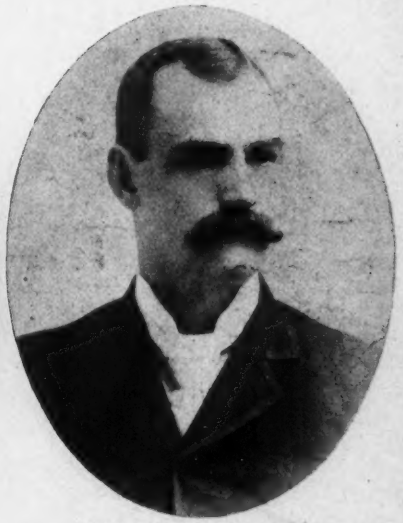
P. M. DINAN, Supervisor of Track
Lehigh Valley R. R.

C. A. DINGLEY, Roadmaster
Chicago, Rock Island & Pacific Ry.

J. M. DOLLAR, Roadmaster
Missouri Pacific Ry.

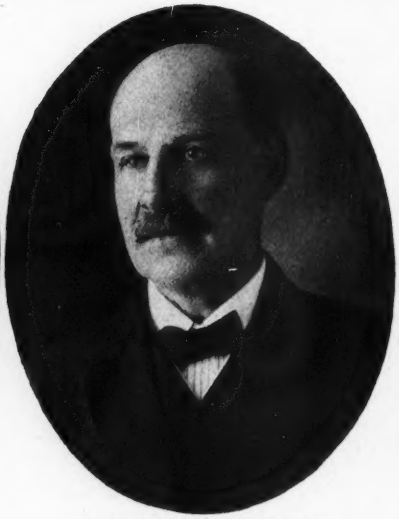
MAURICE DONAHOE, Roadmaster
Chicago & Alton Ry.

J. O. DONAHUE, Roadmaster
Minneapolis, St. Paul & Sault Ste. Marie



WM. DOWNEY, Roadmaster
Minneapolis, St. Paul & Sault Ste. Marie

J. J. DUFFY, Roadmaster
Chicago & Illinois Western R. R.



S. T. EARLEY, Roadmaster
Elgin, Joliet & Eastern Ry.

F. W. ECKLES, Supv. of Construction
Erie R. R.

W. J. EDWARDS, Roadmaster
Alabama Great Southern Ry.

E. F. EGAN, Assistant Roadmaster
St. Louis Southwestern R. R.

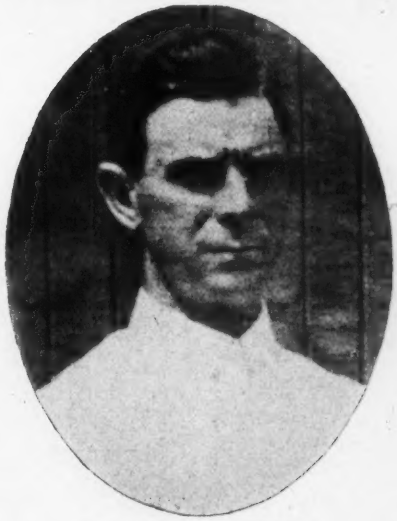
J. W. ELLIS, Roadmaster
St. Louis & San Francisco R. R.

I. C. ELLISON, Roadmaster
Missouri Pacific Ry.

M. H. FARQUHARSON, Roadmaster
St. Louis & San Francisco R. R.

G. E. FARRELL, Roadmaster
Chicago, Rock Island & Pacific Ry.

L. C. FERGUSON
Positive Rail Anchor Co.



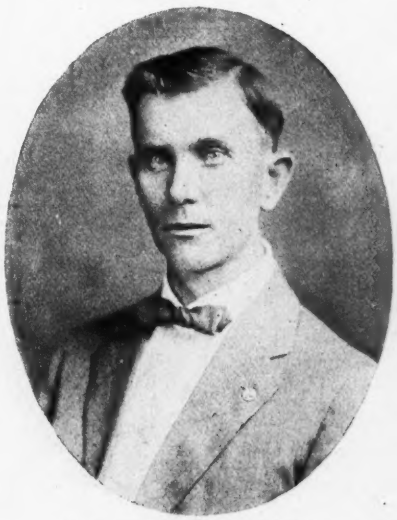
B. A. FITE, Roadmaster
Missouri, Kansas & Texas System

JOHN FITZGERALD, Roadmaster
Buffalo, Rochester & Pittsburgh Ry.

CHAS. FLYNN, Roadmaster
Chicago, Rock Island & Pacific Ry.

O. J. FRANKLIN, Roadmaster
Chicago, Milwaukee & St. Paul Ry.

GEO. D. GIFFORD, Supervisor of Track
New York Central & Hudson River R. R.



L. GILBERT, Roadmaster
Chicago & North-Western Ry.

GEO. M. GREENE, Roadmaster
Chicago, Rock Island & Pacific Ry.

A. GRILLS, Roadmaster
Grand Trunk & Wabash Rys.

C. H. GRUVER, Roadmaster
Chicago, Rock Island & Pacific Ry.

J. HALLORAN, Roadmaster
Western Pacific Ry.

L. W. HANSLEMAN, Supervisor of Track
New York Central & Hudson River R. R.

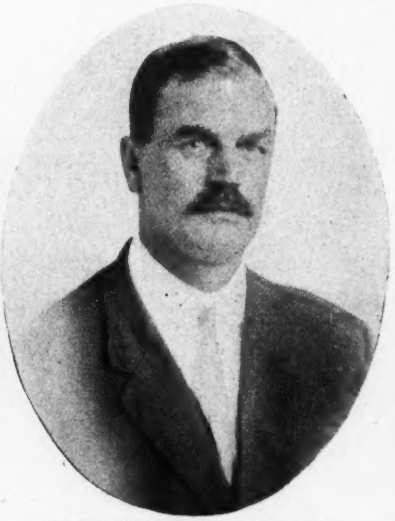
A. E. HANSON, Roadmaster
Atchison, Topeka & Santa Fe Ry.

A. G. HART, Roadmaster
Southern Pacific Co.

J. L. HAYES, Roadmaster
Chicago, Rock Island & Pacific Ry.

W. B. HAYNES, Roadmaster
Seaboard Air Line R. R.

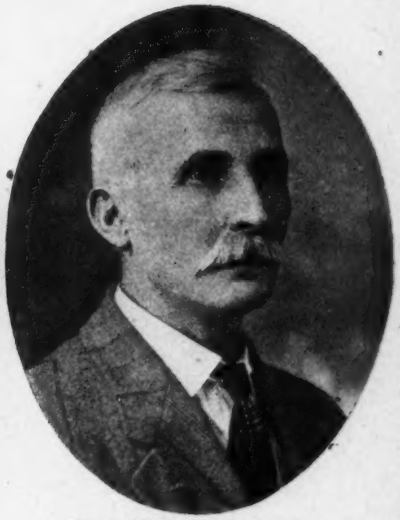
WM. A. HAZELWOOD, Roadmaster
Michigan Central R. R.



JOHN HENBERGER, Roadmaster
Atchison, Topeka & Santa Fe Ry.

JERRY E. HENDERSON, Roadmaster
Atchison, Topeka & Santa Fe Ry.

T. HICKEY, Roadmaster
Michigan Central R. R.

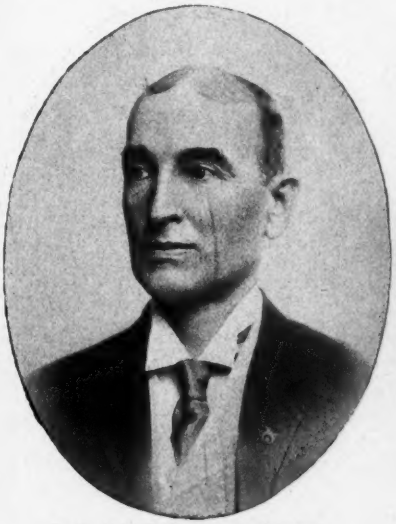


W. M. HICKEY, Roadmaster
Chicago, Milwaukee & St. Paul Ry.

J. C. HINKLE, Roadmaster
Davenport, Rock Island & North-Western

R. H. HOLM, Roadmaster
Missouri Pacific Ry.

JOHN C. HORNING, Roadmaster
Buffalo, Rochester & Pittsburgh Ry.



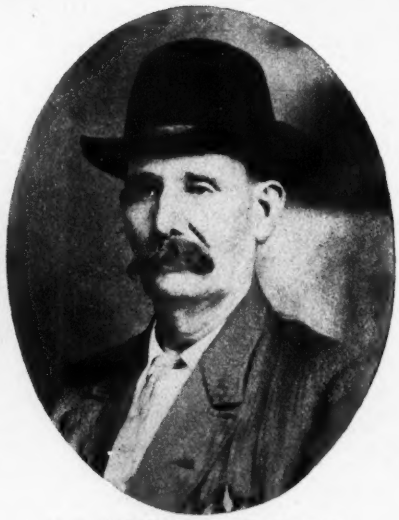
E. K. HORTON, Superintendent
Pullman Co.

J. E. HOVING, Roadmaster
Northern Pacific Ry.

G. B. HOWARD, Chf. Engr. and Rdm.
M. T. R. R. and N. T. Ry.

J. J. HUGHES, Roadmaster
St. Louis Southwestern R. R.

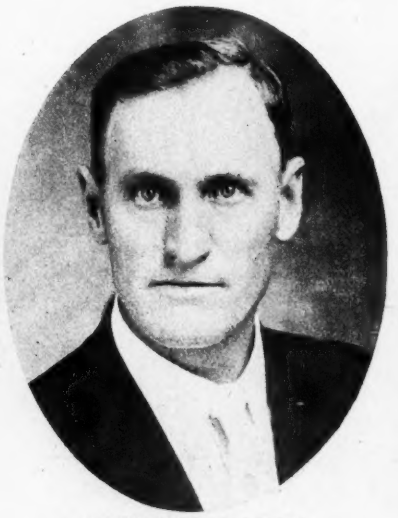
M. S. HURLESS, Roadmaster
Chicago & North-Western Ry.



J. G. HUTCHINSON, Roadmaster
Chicago, Rock Island & Pacific Ry.

JOHN F. JOHNSON, Supervisor of Track
New York Central & Hudson River R. R.

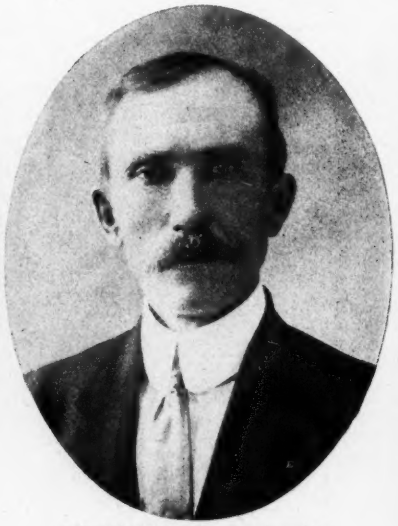
W. D. JOHNSON, Assistant Supervisor
Duluth, South Shore & Atlantic Ry.



A. KAERICHER, Roadmaster
Chicago, Ottawa & Peoria Ry.

THOS. KEARNEY, Supervisor of Track
General Electric Co.

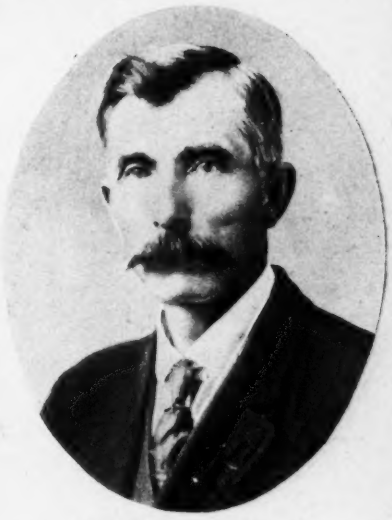
J. H. KENNEDY, Roadmaster
Missouri Pacific Ry.



COLEMAN KING, Roadmaster
Long Island R. R.

S. A. KINZIE, Supv. Trk.
New York Central & Hudson River R. R.

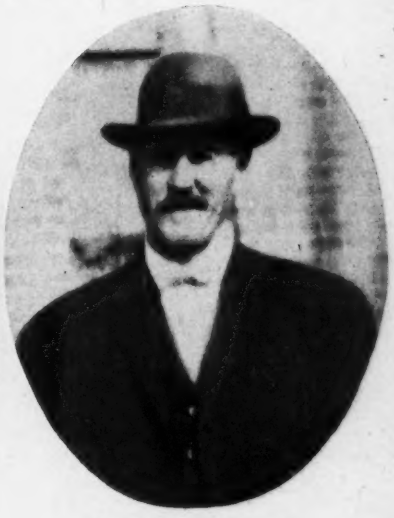
W. H. KOFMEHL, Roadmaster
Chicago, Milwaukee & St. Paul Ry.



JOHN KOVAR, Roadmaster
Northern Pacific Ry.

J. A. LAMBERT, Roadmaster
Escanaba & Lake Superior R. R.

WM. LAWLESS, Supervisor
Buffalo & Susquehanna R. R.



E. LEAON, Roadmaster
Chicago Great Western R. R.

C. M. LEWIS, Supv. Trk.
Erie R. R.

C. L. LINDSAY, Roadmaster
Ann Arbor R. R.

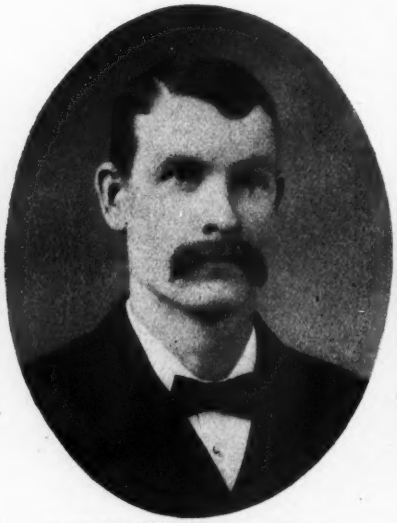
C. LINEHAN, Roadmaster
Chicago, Rock Island & Pacific Ry.

P. H. LOFTUS, Supervisor of Construction
Belle Ry.

G. LOWERS, Supervisor
Erie R. R.

P. J. McANDREWS, Roadmaster
Chicago & North-Western Ry.

H. McCLAIN, Roadmaster
Ft. Smith & Western R. R.



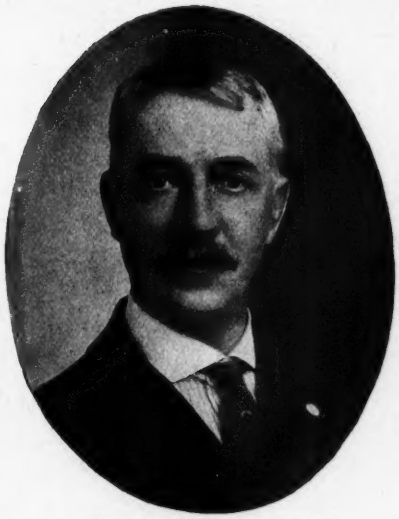
D. McCOOE, Supervisor of Track
Grand Trunk Ry.

S. A. McCREERY, Roadmaster
Chicago Great Western R. R.

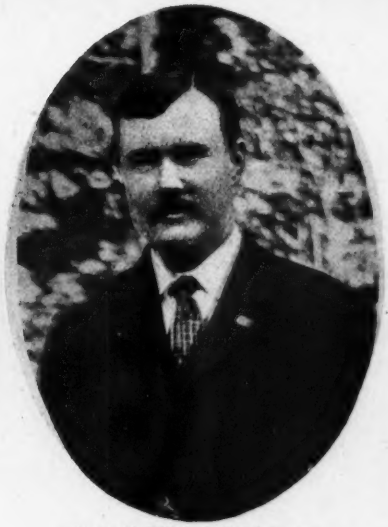
W. J. McDermott, Roadmaster
Chicago & North-Western Ry.

J. McGARRY, Supervisor of Track
New York Central & Hudson River R. R.

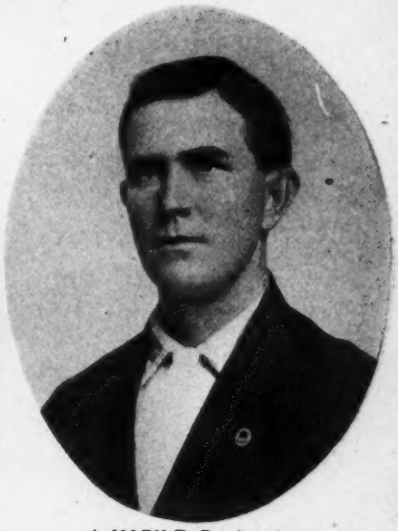
J. W. McMANAMA, Roadmaster
Boston & Maine R. R.



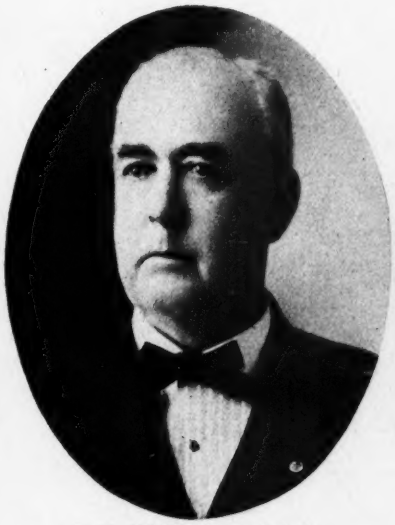
R. McNABB, Roadmaster
Michigan Central R. R.



W. N. McNEILL, Roadmaster
Seaboard Air Line R. R.

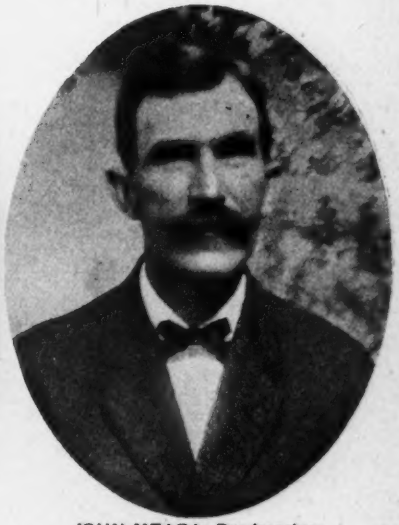


J. MABILE, Roadmaster
Chicago, Rock Island & Pacific Ry.



P. H. MADDEN, Roadmaster
Chicago, Milwaukee & St. Paul Ry.

J. M. MEADE, Engineer Eastern Lines
Atchison, Topeka & Santa Fe Ry.



JOHN MEARA, Roadmaster
Illinois Traction System

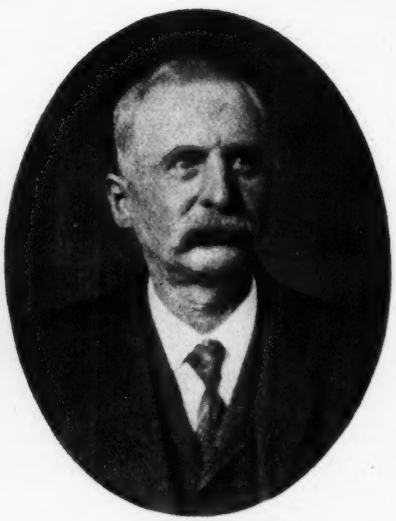
J. W. MILETT, Roadmaster
Chicago Great Western R. R.

TIMOTHY MORIARITY, Roadmaster
Columbia & Puget Sound R. R.

W. F. MUFF, Roadmaster
Atchison, Topeka & Santa Fe Ry.

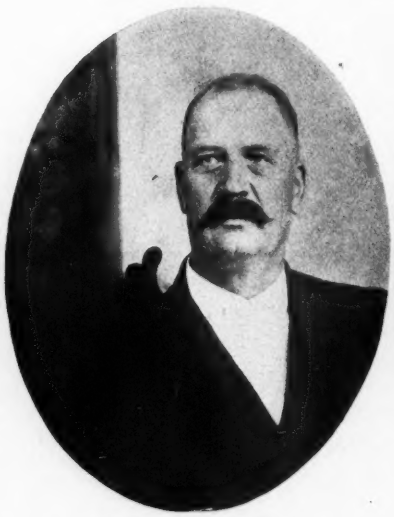
T. J. MULLIN, Roadmaster
Chicago, Milwaukee & St. Paul Ry.

J. MULVOY, Roadmaster
Mobile & Ohio R. R.



P. MUNGAVIN, Roadmaster
Northern Pacific Ry.

A. E. MUSCHOTT, Roadmaster
Chicago, Rock Island & Pacific Ry.



C. J. MUSCHOTT, Roadmaster
Pere Marquette R. R.

JOHN NASH, Supervisor
Lehigh Valley R. R.

JOHN V. NEUBERT, Engineer of Track
New York Central & Hudson River R. R.

WM. NIETMAN, Supervisor
Wabash R. R.

JAS. O'BRIEN, Assistant Supervisor
Terminal R. R. of St. Louis

D. O'HERN, Supervisor
Elgin, Joliet & Eastern R. R.

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S. L. PURDY, Roadmaster
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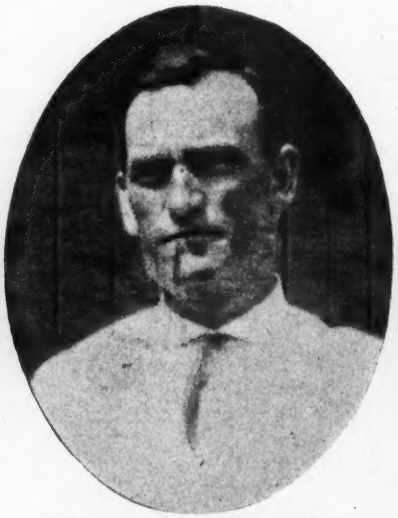
H. H. RENFROE, Roadmaster
Atlantic Coast Line R. R.

W. H. RICE, Superintendent
Los Dos Estrellas Ry.

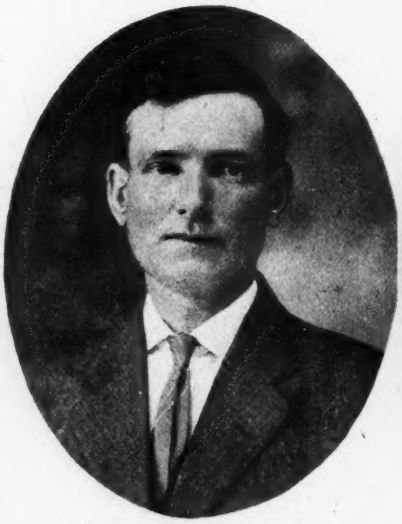
A. C. RUPP, Supervisor
Big Four Ry.



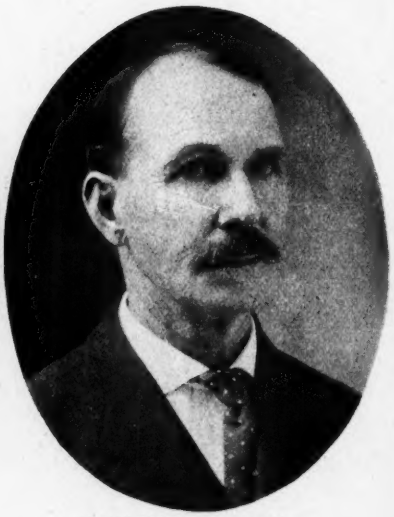
C. M. RUTHERFORD, Roadmaster
Missouri, Kansas & Texas Ry.

W. O. RUTHERFORD, Roadmaster
Chicago Great Western R. R.

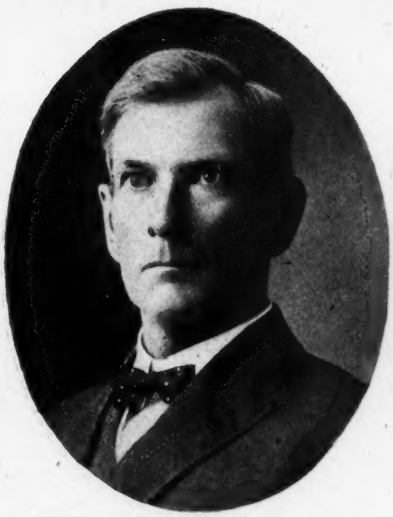
A. SCHERRY, Roadmaster
St. Louis & San Francisco R. R.



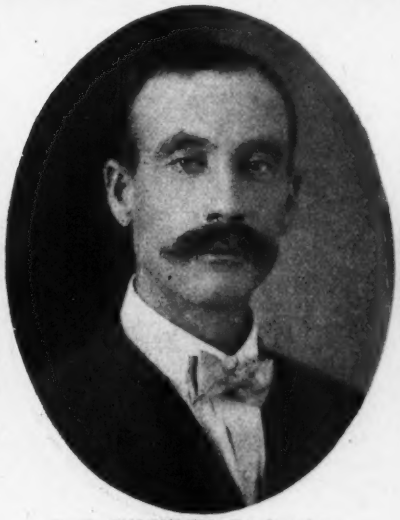
H. W. SCOTT, Roadmaster
Lorain, Ashland & Southern Ry.



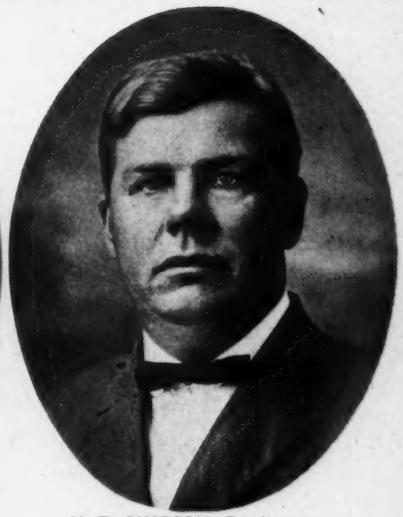
JOHN SHEA, Roadmaster
Detroit & Iron Range R. R.



JOHN P. SHEEHAN, Roadmaster
St. Louis & San Francisco R. R.



R. E. SHOCKLEY, Roadmaster
Missouri Pacific Ry.

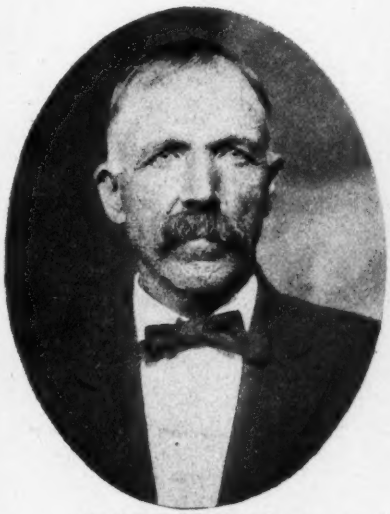


V. B. SIMPSON, Roadmaster
Chicago, Rock Island & Pacific Ry.

J. L. SINGLE, Roadmaster
Public Service Co.

PORTER SIPE, Supervisor
Western Maryland Ry.

W. N. SKELTON, Supervisor of Track
New York Central & Hudson River R. R.



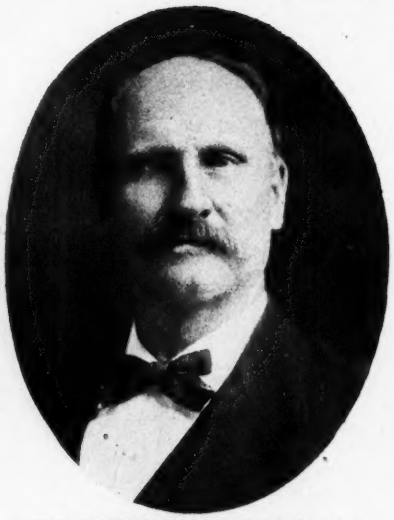
P. SLOAN, Roadmaster
Kansas City Southern Ry.

W. A. STECKEL, Roadmaster
Beebe Lines.

J. W. STEWART, Roadmaster
Missouri Pacific Ry.

G. H. STROPLE, Roadmaster
Missouri Pacific Ry.

JAMES SWEENEY, Supervisor
Chicago & Eastern Illinois R. R.



MIKE SWEENEY, General Roadmaster
Texas Midland R. R.

A. W. TABBERT, Roadmaster
Chicago & North-Western Ry.

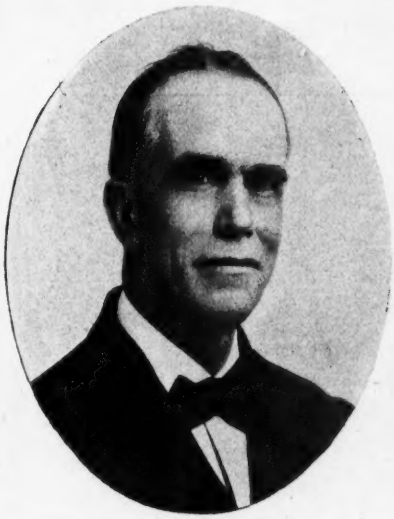
J. TEHAN, Roadmaster
Chicago & North-Western Ry.

J. A. TETER, Supervisor of Track
New York Central & Hudson River R. R.

T. THOMPSON, Roadmaster
Atchison, Topeka & Santa Fe Ry

G. T. TWEED, Roadmaster
Buffalo, Rochester & Pittsburgh Ry.

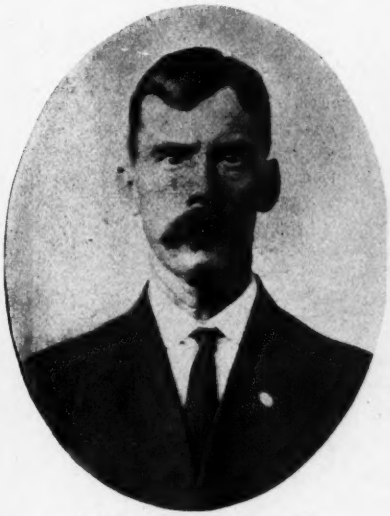
CHAS. TWEEDIE, Roadmaster
Bangor & Aroostook R. R.



A. M. VAN AUKEN, Engineer
Chicago, Rock Island & Pacific Ry.

H. VAN GORDER, Roadmaster
Chicago & North-Western Ry.

F. W. VINCENT, Supervisor
New York Central & Hudson River R. R.



G. B. WALTERS, Supervisor
Big Four Ry.

E. W. WALCH, Roadmaster
Chicago & North-Western Ry.

ALBERT WARREN, Supervisor
Grand Trunk Ry.

WM. WARRENBURG, Supervisor
Lehigh Valley R. R.

JOHN WELCH, Roadmaster
El Paso & Southwestern Ry.

J. T. WELCH, Supervisor
New York Central & Hudson River R. R.

A. A. WELLS, Roadmaster
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WM. WHITE, Roadmaster
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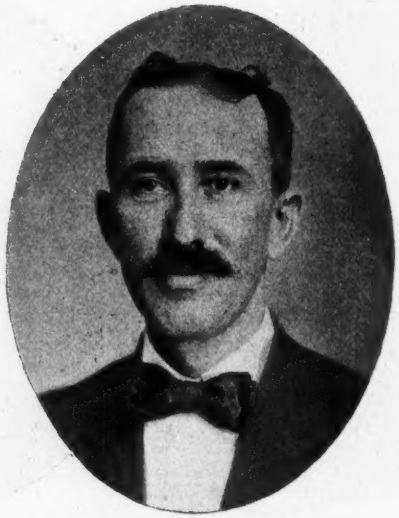
SOLON WHITEHEAD, Supervisor
Wabash R. R.

RICHARD WIBBERLY, Roadmaster
Bangor & Aroostook R. R.

J. WIDEMAN, Roadmaster
Iowa & Illinois Ry.

J. E. WILKINSON, Roadmaster
Chicago & North-Western Ry.



E. M. WINDHAM, Roadmaster
Seaboard Air Line R. R.

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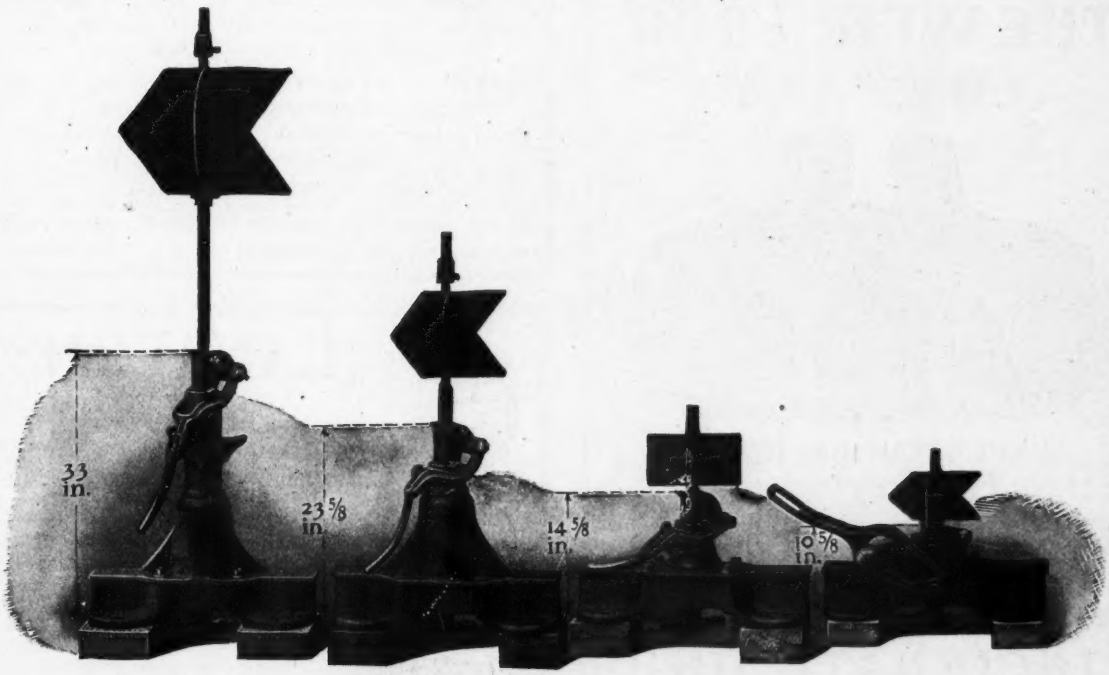

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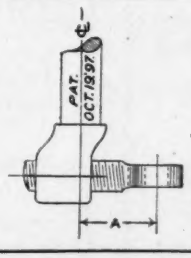
3. **ADJUSTABLE FEATURES.**—All Ramapo Safety Switch Stands are furnished with adjustable throw and adjustable moving rods, unless otherwise ordered. Adjustable switch rods are not required as either switch point can be adjusted. The throw can always be adjusted to suit that of any switch, one-half turn of the eye bolt crank affecting the throw one-twelfth of an inch. See table of crank adjustments below. The distance of stand from switch can be readily adjusted with the adjustable moving rod without moving the stand on the ties.

CRANK ADJUSTMENTS FOR RAMAPO SAFETY SWITCH STANDS

THROW OF STAND	"A"		THROW OF STAND	"A"
3½"	2 13/32"		4½"	3"
3⅝"	2 9/16"		4⅝"	3 3/32"
3¾"	2 31/32"		4¾"	3 3/16"
3⅞"	2¾"		4⅞"	3 9/32"
4"	2 7/8"		4¾"	3 11/32"
4⅛"	2 15/16"		4⅞"	3 7/16"
4¼"	3"		5"	3 13/32"



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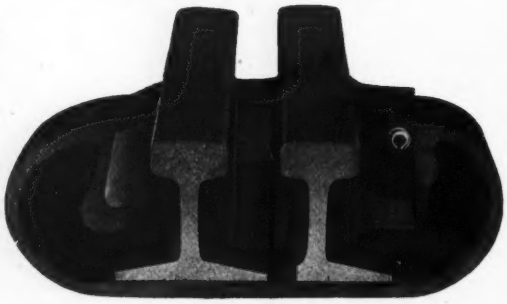

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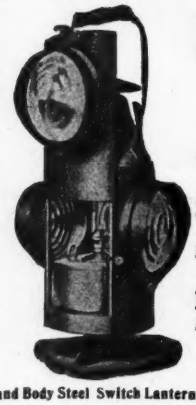

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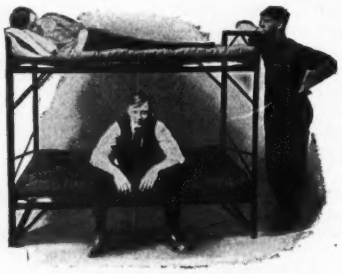

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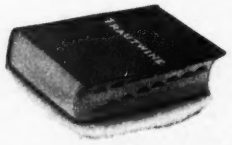

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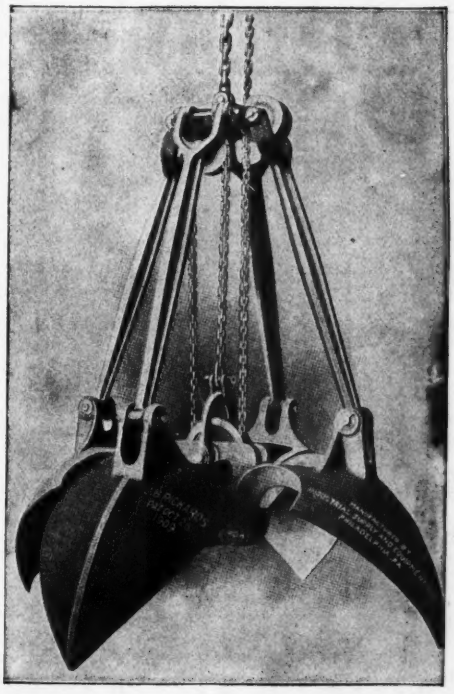

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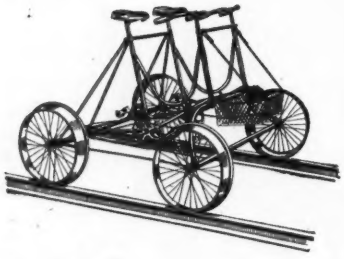

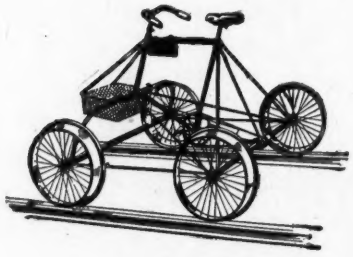

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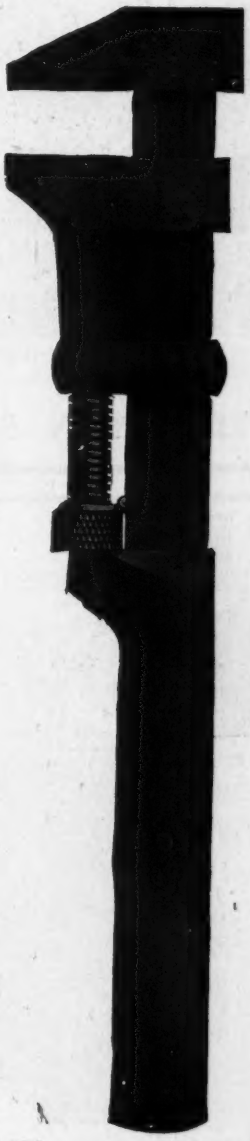

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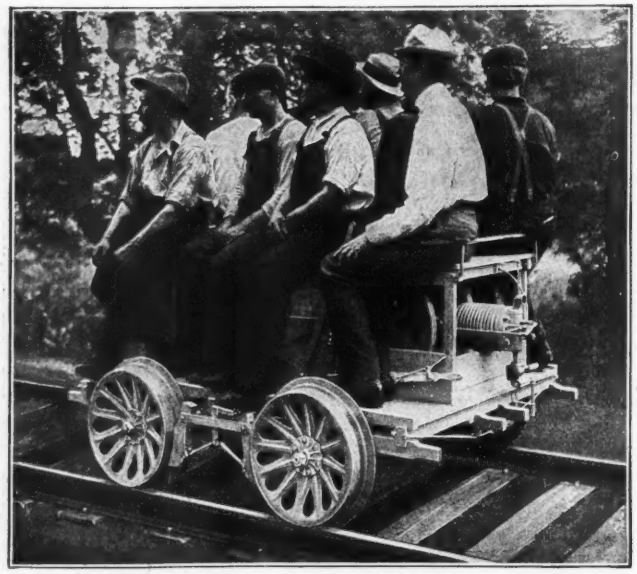

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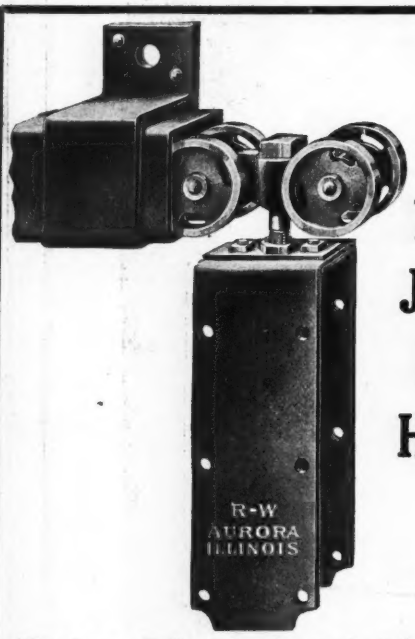

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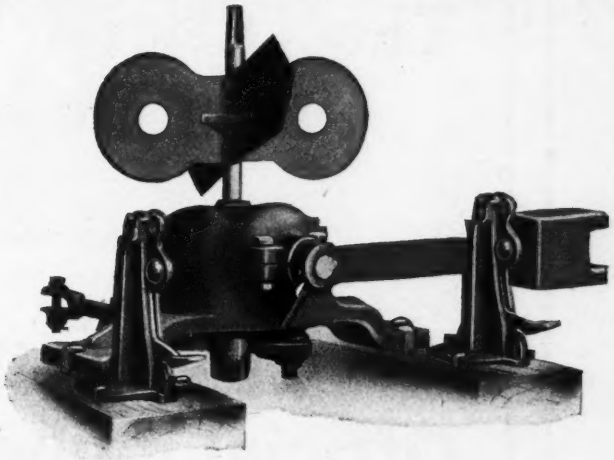

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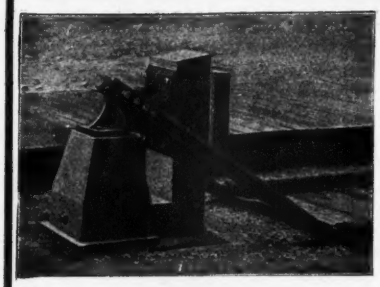

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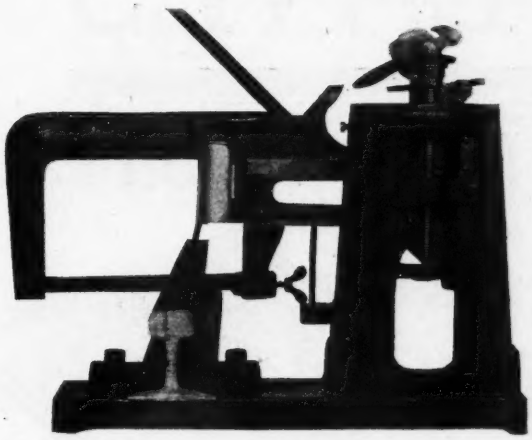

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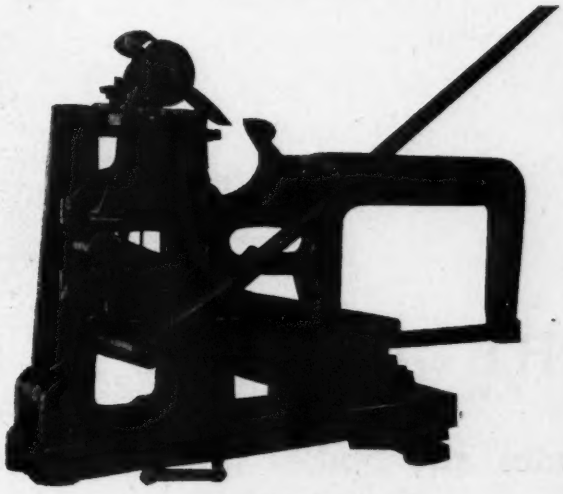

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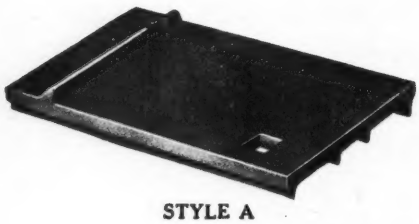

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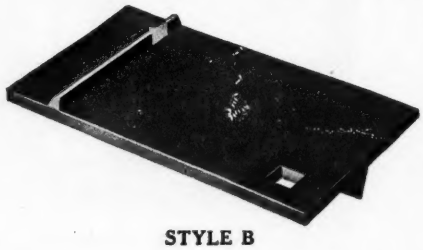

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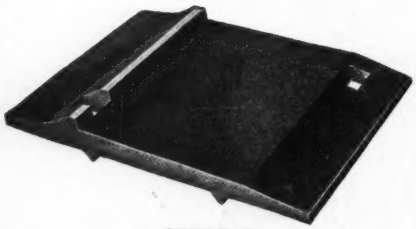

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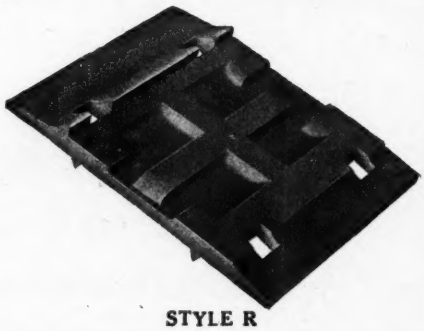
Tie Plates



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Cincinnati Frog & Switch Co., Cincinnati.
Frog, Switch & Mfg. Co., Carlisle, Pa.
Indianapolis Switch & Frog Co., Springfield, O.
Ramapo Iron Works, Hillburn, N. Y.
Weir Frog Co., Cincinnati.

Switchboard Adjusters.
Weir Frog Co., Cincinnati.

Tanks and Tank Fixtures.
Bowser, S. F., & Co., Ft. Wayne, Ind.
Chicago Bridge & Iron Works, Chicago.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Telegraph and Telephone Supplies.
Central Electric Co., Chicago.
Hubbard & Co., Pittsburg.

Terminal Blocks.
United Electric Apparatus Co., Boston, Mass.

Tie Plates.
Atlas Railway Supply Co., Chicago.
Dilworth Porter & Co., Pittsburg.
Hart Steel Co., Elyria, O.

Track Drills.
Cooks Standard Tool Co., Kalamazoo, Mich.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Track Jacks.
Cooks Standard Tool Co., Kalamazoo, Mich.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Track Laying Cars.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Track Materials.
Atlas Railway Supply Co., Chicago.
Frog, Switch & Mfg. Co., Carlisle, Pa.
Indianapolis Switch & Frog Co., Springfield, O.
Ramapo Iron Works, Hillburn, N. Y.
Verona Tool Works, Pittsburg, Pa.
Weir Frog Co., Cincinnati.

Track Tools.
Cooks Standard Tool Co., Kalamazoo, Mich.
Hubbard & Co., Pittsburg, Pa.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.
Verona Tool Works, Pittsburg, Pa.
Wyoming Shovel Works, Wyoming, Pa.

Transfer Tables.
Nichols, Geo. P., & Bro., Chicago.

Trolley Brackets.
Electric Ry. & Equip. Co., Cincinnati, O.

Turntable Tractors.
Nichols, Geo. P., & Bro., Chicago.

Turntables.
Chicago Bridge & Iron Works, Chicago.
Nichols, Geo. P., & Bro., Chicago.

Valve Grease, Graphite.
Dixon, Joseph, Crucible Co., Jersey City, N. J.

Velocipede Cars.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Ventilating System.
Gale Installation Co., Chicago.

Washers.
Hubbard & Co., Pittsburg, Pa.

Water Columns.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Water Coolers.
Gray, Peter, & Sons, Boston.

Water Filters.
International Wagner Water Still Co., Chicago.
Pittsburg Filter Mfg. Co., Pittsburg, Pa.

Water Softeners.
Booth, L. M., Co., New York, N. Y.
International Wagner Water Still Co., Chicago.
Pittsburg Filter Mfg. Co., Pittsburg, Pa.

Water Stills.
International Wagner Water Still Co., Chicago.

Wedges.
Hubbard & Co., Pittsburg, Pa.

Wheelbarrows.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Wing Fence Aprons.
Calumet Supply Co., Calumet, Ill.

Wires.
Central Electric Co., Chicago.

Wire Tapes and Cords.
Central Electric Co., Chicago.

Wrecking Frogs.
Johnson Wrecking Frog Co., Cleveland, O.

Wrenches.
Coe's Wrench Co., Worcester, Mass.

Zincs.
Edison, Thos. A., Inc., Orange, N. J.

Nichols Transfer Tables Turntable Tractors
GEO. P. NICHOLS & BRO. - - - - - - - 1090 OLD COLONY BUILDING, CHICAGO

BOOTH WATER SOFTENER
Clean Boilers — No wasted fuel — Ask for free Booklet
L. M. Booth Co., 130 Liberty Street, New York

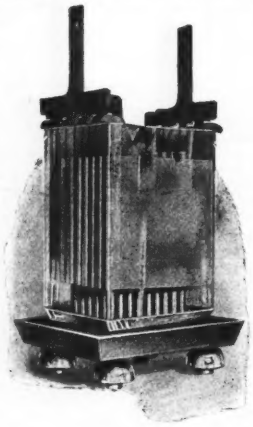
Read the Ads

Spring Frogs
Rigid Frogs
Crossings
The Cincinnati Frog & Switch Company
Track Equipment for Steam or Electric Railroads
Manufacturers
CINCINNATI, O.
Split Switches
Switch Stands
Rail Braces

U.S.L. TRADE MARK
THE UNITED STATES LIGHT AND HEATING CO.
(Formerly National)

Storage Batteries For Signal Service

U-S-L batteries discharge only when the signal circuit is closed. Although the service be extremely intermittent they retain their capacity—no energy being dissipated uselessly by internal discharge. This desirable feature is secured by our advanced methods of manufacture and the absolute purity of our raw materials.



The U. S. Light & Heating Co.

GENERAL OFFICES: 30 Church Street, New York
FACTORY: Niagara Falls, New York

BRANCH OFFICES AND SERVICE STATIONS:
New York Boston Buffalo Cleveland Detroit Chicago
St. Louis San Francisco

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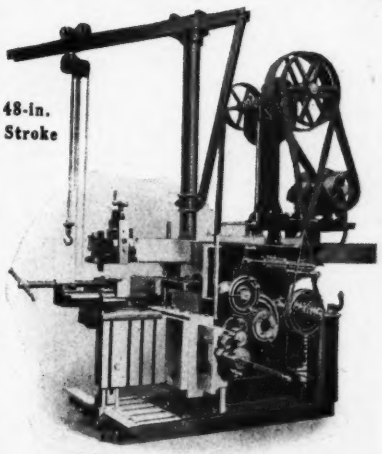
A Machine for the ENGINEERING Department



48-in. Stroke

MORTON SPECIAL DRAW CUT FROG AND SWITCH SHAPER

IT is BUILT ESPECIALLY FOR THE WORK and has a SPECIAL HEAVY VISE for HOLDING RAILS FOR NOTCHING.

The STRONGEST, Most POWERFUL and EFFICIENT SHAPER BUILT.

Some of the large Manufacturers of Frogs and Crossings have from TWO to SIX of these machines in operation.

The railways which operate the largest frog and crossing plants have found that the work of these shapers is such as to make them indispensable.

BUILT and guaranteed by THE SAME COMPANY which makes the SPECIAL 32" RAILROAD DRAW-CUT SHAPER.

MORTON MFG. CO., Muskegon Heights, Mich.

Write for Bulletin Number Ten

Kalamazoo Hand Cars

are equipped with the Kalamazoo Improved Reinforced Pressed Steel Wheel, giving 50 to 100 per cent greater wear than any other wheel of similar design or weight on the market. The car has stout gallows frame, thoroughly trussed, has taper wheel and pinion fits on axles, machine cut gears, flexible steady box and double acting brake.

16 Different Styles, Standard or Special

Catalogue of Track and Railway Supplies on Request

Kalamazoo Railway Supply Co.

Kalamazoo, Mich.

Western Representative: Universal Railway Supply Co., Chicago

IRONITE

For Waterproofing Concrete, Wood, Brick And All Porous Material

JUST MIX WITH WATER AND APPLY WITH BRUSH

A Five Year Guarantee Against Saturation

Approved by U. S. Government

Sample free on request

M. J. EGLESTON, Railway Sales Agent

KARPEN BLDG., CHICAGO 1

If YOU can find an error in the July issue of

The Monthly Official Railway List

you will be given a year's subscription to

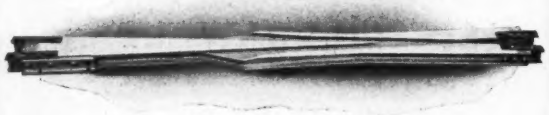
Railway Engineering

or your subscription will be extended one year.

SEE OFFER ON PAGE 113, JULY ISSUE OF

The Monthly Official Railway Lis

Low first cost and high maintenance charges or efficiency and economy, which?

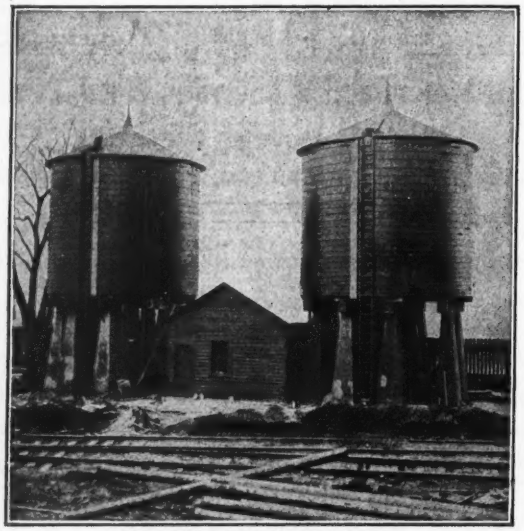


Solid Manganese Frogs and Crossings

OF DESIGNS THAT EMBODY STRENGTH AND DURABILITY ELIMINATING MAINTENANCE AND FAILURES IN TRACK.

"INDIAN" BRAND GENUINE MANGANESE STEEL USED IN ALL OUR WORK!

The Frog, Switch & Mfg. Co.
Carlisle ESTABLISHED 1881 Penna.



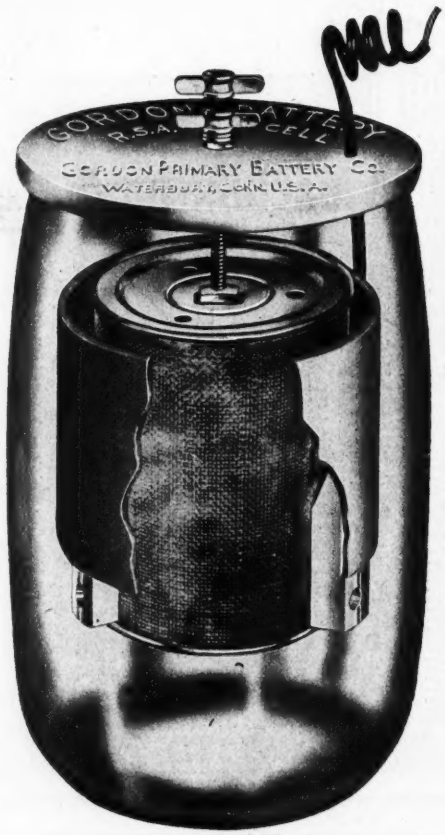
INTERMITTENT SOFTENER

SOFTENERS

Continuous — Intermittent

Gravity--- **FILTERS** *---Pressure*

PITTSBURGH FILTER MFG. CO.
Kansas City PITTSBURGH Chicago
E-2



You Don't Know the New Type Gordon RSA Cell

unless you have received a shipment within the past month.

WONDERFUL improvements in formula and construction make the GORDON CELL cost *much* less per ampere hour than any other Primary Cell now on the market.

Drop in voltage under heavy discharge rate *considerably* less than that of any other Primary Cell.

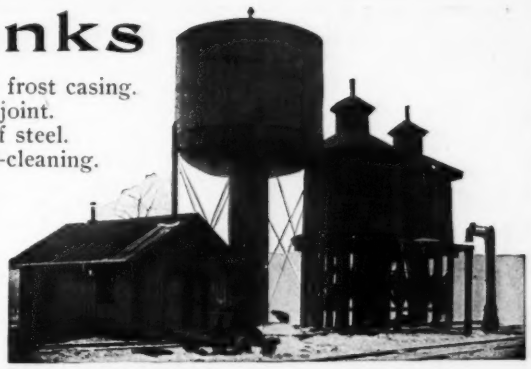
Tell us to tell you about it.

GORDON PRIMARY BATTERY CO.
50 Church St., New York, N. Y.
Peoples Gas Building, Chicago

Steel Water Tanks

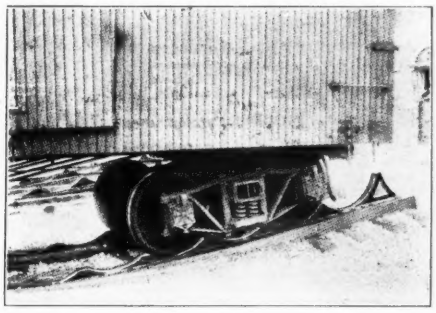
Have pleasing appearance, long life, low maintenance cost.
Will not rot, burst or burn.
Remain absolutely water-tight.
Require no wooden frost casing.
Need no expansion joint.
Are built entirely of steel.
Are practically self-cleaning.
Cost about same as wooden tanks.

Write for plans, specifications and prices before placing your order. Descriptive catalogue No. 14 ready for distribution.



Chicago Bridge & Iron Works

Chicago
New York
Dallas, Texas
Greenville, Pa.



THE SAUNDERS CAR STOPPER

BUMPING POSTS

ARE A VERY NECESSARY PART OF TRACK EQUIPMENT.

Why not use one that does no damage to equipment or track, regardless of the force of the impact, because of the

Gradual Resistance

Made possible by the construction and which is an exclusive feature of

The Saunders Car Stopper

We have records of service tests to prove our claims—we install them subject to approval.

SOUTHERN RAILWAY SUPPLY COMPANY

Manufacturers and Sales Agents — 113 No. Second St., St. Louis, Mo.

Does Your Block System Block the Law?

Block Systems are wholly dependent on the Relay equipment. In so far as the Relay fails of performance, do you transgress the law.

Ziegler Relays

Are the Carefully Built Relays

They are manufactured with an eye single to accurate performance—made to preclude the possibility of accident.

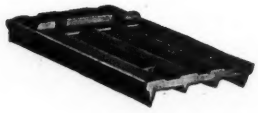
The Railway Signal Association approves our apparatus.

United Electric Apparatus Co., Boston, Mass.

DILWORTH, PORTER AND CO., Ltd.
PITTSBURGH, PA.

TIE PLATES AND SPIKES

GOLDIE PLATE

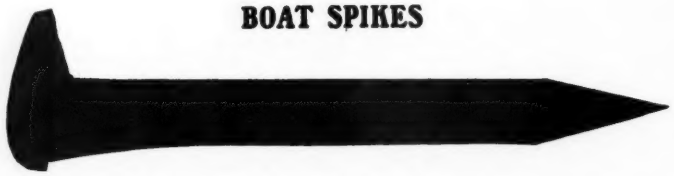


DILWORTH FLANGE PLATE

HARRIMAN PLATE

Standard and Special Railroad Spikes

BOAT SPIKES



Goldie Perfect Spikes a Specialty

All spikes are shipped in steel hooped kegs

THE Merit of "Indianapolis" Products appeal to the discriminating *Engineer* and *Roaaway Official*, who is progressive, practical and recognizes the value of Final efficiency and economy rather than low first cost with excessive maintenance and interrupted operating schedule.

He wants to know that all

Materials are strictly and absolutely first quality throughout.

Nothing but first quality rails and fittings go into any part of our product.

Nothing but American "**Stag**" Brand of manganese (the most dependable and serviceable metal of its kind yet produced) is used in our manganese work and in combination with scientific designing and liberal sections with a maximum safety factor—

Nothing is better (no exceptions).

He wants to know that

Workmanship and Methods are confined to the best modern practices only.

Our works are located at Springfield, Ohio.

We have every modern and improved facility for the most economical production of strictly High Class Product.

But employ no practices or methods to lessen the cost of production that are in any way detrimental to the steel or other material.

All rails are drilled—never punched.

All bolted structures are UNIT DRILLED and bolts a driving fit.

All rivets are compression driven—70 tons maximum pressure.

All manganese is accurately fitted and ground at a low temperature.

Result—Costs some more—worth much more.

He wants to know that

Design embodies strength and endurance and eliminates weakness and failures.

"**Conservation of Energy**" is a science which applied to Track and Rolling Stock has done more than any other one thing to bring into favor and recognition the "**Indianapolis**" Designs and their adoption by the leading and best roads in the country.

Our designs are the results of our own experience and observation together with a composite of suggestions of the most able Engineers and track men.

Designs that favor and protect both the structure and rolling stock.

Indianapolis built up designs of Regular Construction are reinforced and self-contained, prolong the life of the work.

Indianapolis R-N-R Designs of Manganese Frogs and Crossings have revolutionized maintenance and when introduced were a radical departure from any known practice, yet have been freely adopted and are extensively in use on nearly all roads of importance where purchases are not restricted.

Indianapolis R-N-R Designs have features of exclusive merit not found in any others.

Indianapolis Manganese Designs of Insert Special Work, were the first to feature the renewal of rail parts without removing from the track for repairs.

He wants to know

where to get what he needs.

It is made at

Springfield, Ohio.